A Best Practices Guide for the Prevention of Falls Among Seniors Living in the Community

Prepared on behalf of
the Federal/Provincial/Territorial Committee
of Officials (Seniors) for the Ministers Responsible for Seniors

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EXECUTIVE SUMMARY

Overview

A Best Practices Guide for the Prevention of Falls Among Seniors Living in the Community was prepared for the officials of the federal, provincial and territorial Ministers Responsible for Seniors in response to the Ministers' request for a review of fall prevention programs and practices and to provide the evidence for effective approaches for reducing injury among seniors as well as efficient means of delivering prevention programs. The *Guide* is based primarily on a systematic review of the studies evaluating the effectiveness of fall prevention strategies for community-dwelling seniors and then, based on these studies, determining effective interventions and strategies.

Research Issues

In interpreting the findings presented in the *Best Practices Guide*, it is necessary to be aware of research issues and limitations that can affect confidence in the results and the ability to generalize the information to other settings. Some of the most important issues within the reviewed body of literature included:

- Studies typically evaluated a strategy, rather than an entire program for reducing falls and fall-related injuries.
- A reduction in risk factors does not necessarily lead to reductions in falls and fall-related injuries.
- Due to their low incidence, only very large studies can detect differences in fall-related injuries. Although it may be expected that an overall reduction in falls would lead to a reduction in fall-related injuries, there is little data to support this claim one way or another.
- Different studies tend to use different definitions of falls, thereby reducing comparability between studies.
- Monitoring falls among community-dwelling seniors is very difficult. Most studies relied on self-report methods of monitoring, likely leading to an under-reporting of falls.

Best Practices

The evidence for best practices was primarily derived from the thirty-four studies that met the selection criteria for the systematic review. Each study was categorized into one of six sections according to the primary focus of the intervention: exercise, environment modifications, education, medication, clinical intervention, and multi-factorial intervention. A seventh category, health promotion approaches, was also included in the *Best Practices Guide*, although no studies were found that met the selection criteria of the systematic review for this type of approach to falls prevention.

Exercise Best Practices

- ***The evidence supports certain exercise regimes as an effective strategy for reducing falls.***
- ***Balance training was a component in most exercise programs where there was a statistically significant reduction in fall.***
- ***The use of Tai Chi exercises to enhance balance was the only effective strategy that was examined in isolation of other strategies.***
- ***More research is needed to determine which types of exercise programs are most effective for reducing falls.***
- ***More research is needed to determine which strategies are most appropriate for seniors with specific balance, strength or mobility problems.***
- ***Careful consideration is recommended when developing exercise programs as it is unclear what the optimal intensity level of exercise programs should be and at least one exercise regime has been shown to increase falls.***

The effect of an exercise strategy is often short- lived without consideration for enhancing compliance over the long-term.

Environmental Modification Best Practices

- ***The evidence suggests that including home modification as part of a fall reduction program is an effective strategy for reducing falls among seniors.***
- ***The success of home modification programs may be enhanced when combined with other strategies such as education and counseling on how to reduce behavioural and physical risk factors that when combined with environmental factors, increase the risk of falling.***
- ***Successful home modification programs often included those with financial and/or manual assistance in completing the modifications***
- ***Occupational therapists' training and skills make them ideal professionals for conducting home assessments as they are able to assess both the senior's environment and their ability to function within that environment***
- ***Success and cost effectiveness of environmental strategies are enhanced by targeting those who are ready for change.***

Readiness for environmental modifications may be linked to having had a recent fall, and/or an increased understanding of the risks and prevention strategies

Education Best Practices

- ***There is little evidence whether or not education programs alone are effective in modifying fall risk factors or are effective in reducing falls or fall-related injuries.***
- ***Education strategies may play an important role in multi-faceted risk reduction strategies to increase seniors' awareness and knowledge of fall risk factors, thereby making them more willing to adopt strategies to modify fall risk factors.***
- ***The reduction of falls in one study may have been due in part to the use of theoretical models for adult learners, such as valuing shared learning among peers and peer modeling for change.***

Medication Best Practices

- ***Taking medications from the class of drugs known as benzodiazepines is shown to increase the risk of falling among seniors.***
- ***The evidence appears to support psychotropic drug withdrawal as a means to reduce falls but more studies are needed on the practical application of this strategy.***
- ***Compliance is an important consideration in psychotropic medication withdrawal as it appears difficult for psychotropic drug users to stop, and clinicians may need to consider alternative treatments for anxiety and sleep disorders to enhance compliance.***
- ***There is a possibility that medications to improve physical functioning may reduce falls, but the one study that examined hormone replacement therapy to enhance muscle strength and improve balance failed to produce a change in fall frequency.***

Taking vitamin D3 and bisphosponate alendronate have been shown to reduce the risk of sustaining a fracture among women. However, no studies were found targeting community-dwelling seniors that establish a link between fall-related injuries as an outcome and the use of medications to enhance bone density.

Clinical Intervention Best Practices

- ***Clinical assessments by nurses or physicians appear to be an effective strategy in reducing falls and related injuries but these effects have not been assessed in isolation of other strategies.***
- ***One study found that over half of the emergency room patients admitted for fall injuries had balance deficits and visual impairments.***
- ***For seniors who have sustained a fall, a thorough medical assessment should be conducted for underlying physical or cognitive contributors to the fall.***
- ***Screening for physical and cognitive impairments that contribute to falling appears to be effective when combined with interventions to reduce behavioural and environmental risk factors associated with falling.***
- ***The skills of occupational therapists, or nurses trained in fall risk assessment and prevention, were used following clinical assessments to determine the best supports to enhance physical functioning within the senior's home and community environment.***
- ***One study indicates that initial screens may be conducted by trained volunteers, supervised in the use of reliable risk assessment questionnaires, providing referrals are made to the appropriate health or social service providers.***

Multi-Factorial Best Practices

- ***A number of studies indicate that multiple strategies directed at a wide range of risk factors are effective in reducing falls and fall-related injuries.***
- ***Multidisciplinary teams of heath practitioners trained in the detection and prevention of fall risk factors are necessary to address the complex combination of factors that contribute to falls among the elderly.***
- ***Effective outcomes may require a combination of strategies such as subsidies for home modifications and safety equipment, and accessible health and social services tailored to the safety needs of seniors at risk - such as the delivery of sand in winter months to isolated seniors.***
- ***More research is needed to understand the contribution of specific strategies in reducing falls and related injuries and the potential benefits of combinations of strategies.***
- ***Education strategies may play an important role in multifaceted risk reduction strategies to increase seniors' awareness and knowledge of fall risk factors, thereby making them more willing to adopt strategies to modify fall risk factors.***
- ***Dissemination of information to large groups may be best conducted through multiple strategies such as mass media, workshops, classes, and meetings held in local seniors' centres***

Health Promotion Approaches to Best Practices

- ***Community-based strategies allow for multifaceted approaches.***
- ***Seniors are key participants in the design and implementation of community-based strategies.***
- ***The involvement of multiple stakeholders has the potential to facilitate and significantly enhance the success of prevention initiatives.***
- ***Fostering partnerships among stakeholders increases local acceptance and commitment, accesses local knowledge, expertise, and resource; and increases community capacity.***

Issues for Further Research

Beyond the research required to identify effective strategies for fall and fall-related injury reduction, other important questions need to be addressed around fall prevention program development and delivery. Three areas of particular importance include: the target population, program acceptance, and compliance.

Resources for Practitioners

In addition to evidence for the systematic review, a table of resources and relevant information available through the Internet is provided (Appendix 2). Also included is an evaluation guide to assist programmers in identifying and measuring the goals, process and impact of their fall prevention initiatives (Appendix 3).

Interventions for Preventing Falls and Fall-Related Injuries Among Community-Dwelling Seniors: A Systematic Review of the Literature

I. INTRODUCTION

The personal, economic, and societal costs of falls among seniors in Canada are enormous. Yet, up to now, relatively little has been done to address this serious health threat. Each year, one third of all seniors experience at least one fall (O'Loughlin, 1993), with approximately half of these falls resulting in minor injury, and 5% to 25% resulting in serious injury such as fractures or sprains (Alexander et al., 1992, Nevitt et al., 1991). Among Canadian seniors aged 65 and older, falls accounted for 57% of deaths due to injuries among females and 36% among males (Raina et al., 1997). Of seniors who do survive their injuries, many never fully recover, leaving them with chronic pain, reduced functional abilities, curtailment of activities that may lead to future falls, and a fear of falling again (Grisso et al., 1990, Nevitt et al., 1991, Tinetti, Mednes de Leon, et al., 1994). Such consequences may result in lifestyle changes that have a negative impact on seniors' quality of life (Commodore, 1995) and even result in institutionalization, as evidenced by the fact that 40% of all nursing home admissions can be directly attributable to an elderly person having had a fall (Rawsky, 1998). Those not admitted to nursing homes may become more dependent on others, often creating an additional care-giving burden for their families.

Not surprisingly, given their widespread prevalence, falls also represent a major health care cost. An estimate of the basic costs for fall-related injuries in Canada in 1994 amounted to 2.8 billion dollars (Asche, Gallagher, and Coyte, 1999). This cost does not take into account the long-term consequences of fall-related injuries that result from higher rates of mortality and morbidity, susceptibility to future falls, loss of independence, and lowered quality of life. Unless the incidence of falls and fall-related injuries can be reduced, the economic costs will likely escalate in the face of an aging population. For example, Statistics Canada estimates that the percentage of seniors in Canada will almost double from 12% in 1996 to 23% in 2041, resulting in over 10 million seniors.

Recognizing the large personal, societal, and economic impact of falls among seniors, the Federal/Provincial/Territorial Ministers Responsible for Seniors have taken a leadership role in forging a strategy to reduce this serious health threat. Their 1999 report entitled, *Enhancing Safety and Security for Canadian Seniors: Setting the Stage for Action*, succinctly highlights the threat of injury due to falls to seniors and suggests steps that need to be taken to help reduce this national problem.

As a result of this work, the F/P/T Ministers Responsible for Seniors commissioned a study to review fall prevention programs and practices and to provide the evidence for effective approaches for reducing injury among seniors, as well as efficient means of delivering prevention programs. The three primary objectives of this study regarding the

reduction of falls or fall-related injuries among community-dwelling seniors were as follows:

1) Develop a national inventory of all programs in Canada;
2) Conduct a literature review to assess the evidence of the effectiveness of interventions; and,
3) Develop a "best practices guide" for all disciplines dealing with falls and for policy makers around the development and implementation of programs.

The national inventory of fall prevention programs has been published in a separate document entitled, *An Inventory of Canadian Programs for the Prevention of Falls Among Seniors Living in the Community* (F/P/T Ministers Responsible for Seniors, 2001). The current document presents the results of the systematic review and Best Practices Guide.

II. SYSTEMATIC REVIEW

A. Goal and Objectives of the Systematic Review

A systematic review of fall prevention programs was conducted with the primary goal of summarizing the evidence for best practices in reducing falls and fall-related injuries among community-dwelling seniors. A systematic review was selected as the means to collect and summarize the evidence for best practices because systematic reviews "differ from other types of reviews in that they adhere to strict scientific design in order to make them more comprehensive, to minimize the chance of bias, and to ensure their reliability." (Deeks et al., 1996) Given these advantages, a systematic review of the literature was conducted to meet the following two main objectives:

1. To collect and review studies that evaluated the effectiveness of fall prevention programs for community-dwelling seniors.
2. To determine the types of interventions and strategies that are most effective for reducing falls among community-dwelling seniors.

B. Methods

1. Advisory Committee

Prior to beginning the systematic review, an advisory committee was formed to help guide the review process as well as the development of the Best Practices Guide. The role of the advisory committee was to help to interpret results, conclusions, and recommendations that arose from the review. The committee members were chosen to ensure a cross-Canada representation that had expertise in fall prevention research, program implementation, clinical practice and policy development.

2. Search Methodology

A comprehensive search methodology was developed based on the systematic review guidelines of the National Health Services, Centre for Reviews and Dissemination (CRD) (Deeks et al., 1996). Selection of articles was conducted to ensure the inclusion of as many relevant published and unpublished studies as possible. Seven search strategies were used, including: multiple electronic database searches, Internet searches, manual checks of reference sections of review articles and studies published in last six months, review of the proceedings for the 2000 Canadian Conference on Injury Prevention and Control and the 2000 Canadian Association of Gerontology Conference, review of studies collected for the companion document to this report – *An Inventory of Canadian Programs for the Prevention of Falls* (Scott, et al., 2001), and a review of the extensive collection of materials contained within the Adult Injury Management Network (AIMNet) library.

3. Document Selection

To identify documents appropriate for the systematic review, a three-step screening process was used as described below.

Step 1: Location of Documents Using Search Strategies

Using the seven search strategies outlined above, 2,614 documents were identified that could potentially be used in the review. Duplicate studies from the electronic database searches were removed as well as studies unrelated to falls prevention (e.g., documents that referred to "fall" as a season). The results of the document search produced 1,339 documents that were screened in Step 2.

Step 2: Screening Based on Initial Inclusion/Exclusion Criteria

Studies located in Step 1 were screened based on inclusion/exclusion criteria, as outlined in the *CRD Guidelines for Those Carrying Out or Commissioning Reviews* (Deeks et al., 1996), and adapted from a previously conducted systematic review of sport and recreational injury prevention (Mackay et al., unpublished). All documents retrieved in Step 1 were screened based on title and abstract. Documents were omitted from the next level of screening if they failed to meet at least one of the inclusion criteria, or met at least one of the exclusion criteria (see Table 1). The results of the inclusion/exclusion screening reduced the number of documents to 674 to be screened in Step 3.

Table 1: Inclusion/Exclusion Screening Criteria

Inclusion Criteria	Exclusion Criteria
1. Topic: Related to fall prevention or fall injury prevention 2. Age Group: Seniors (majority of participants 65 years or older) 3. Languages: English or French 4. Settings: Community-based (majority of participants non-institutional)	1. Studies that target children or youth 2. Studies that target workplace settings 3. Studies of the effectiveness of clinical treatments or post-injury management 4. Studies that describe interventions without providing data concerning outcomes related to reducing falls or fall-related injuries 5. Studies for which the only outcome data is participant evaluation of the intervention program itself

Step 3: Screening Based on Relevance for Systematic Review

The 674 studies that met the inclusion/exclusion criteria were located, retrieved, and assessed for relevance using criteria adapted from the *CRD Guidelines for Those Carrying Out or Commissioning Reviews* (Deeks et al., 1996), and from a previously conducted systematic review of sport and recreational injury prevention (Mackay et al., unpublished). To be judged as relevant for this review, a study had to describe an intervention designed to reduce falls or fall-related injuries among community-dwelling seniors and to evaluate the intervention's effectiveness using falls or fall-related injuries as an outcome (see Table 2). The 34 studies that met the relevance criteria were retained for the data extraction phase of the review.

Table 2: Relevance Screening Criteria

Characteristic	Screening Criteria
Research Topic:	Fall or fall-related injury prevention
Target Population:	Community-dwelling seniors
Intervention:	a) Fall or fall-related injury prevention program/strategy, or b) A relevant policy/regulation/legislative change, or c) Environmental, equipment or product modifications
Outcome:	a) Fall or fall-related injury incidence, or b) Fall or fall-related injury severity
Methods:	a) Quantitative: study design includes a control group or use other comparative measures, or b) Qualitative: study design includes methods to understand the experience of seniors with regard to behaviours aimed at preventing a fall or fall-related injury or action research with the goal of change at a community or societal level to reduce falls and fall-related injuries

4. Data Extraction

All documents that met the relevance criteria were retained for the data extraction phase of the review process. A Data Extraction Form was developed based on other data extraction forms (Gillespie et al., 2000, Leonard et al., 1999, McKay et al., unpublished;), guidelines about conducting systematic reviews (Deeks et al., 1996; Gillespie et al., 2000), and the researchers' knowledge of falls. The data extracted included information on the study characteristics, participants, intervention approaches, targeted (risk) factors, falls definition, study outcomes, and implementation issues. Two reviewers independently extracted the information for each document and then compared results. Any differences were resolved through discussion. The final results of each data extraction were entered into Excel for analysis, a summary of which is presented in Appendix 1.

5. Study Ratings

Each study retained for the review was given a rating based on its research design (RCT vs. non-RCT) and ability to detect a significant effect due to the intervention (power – rated on a 3-point scale). A hierarchical level rating system (adapted from: Deeks et al., 1996; Gillespie et al., 2000; McKay et al., unpublished) was applied to studies assigning each to levels ranging from I (strongest research design and highest power) to IV (weakest research design and lowest power) (see Table 3).

Table 3: Criteria Used to Rate Study Levels

Study Design	Power Rating	Level
RCT	3	Level I
RCT	2	Level II
Non RCT	3	Level II
Non RCT	2	Level III
RCT or Non RCT	1	Level IV

RCT = Randomized Control Trial

Power was rated on a 3-point scale where:

3 = likely enough power or significant changes detected;

2 = somewhat likely to have enough power;

1 = not enough power

Further, the quality of the studies at each level were rated as either A or B based on five criteria to evaluate methodological issues common to falls research (see Table 4). Studies which received an A rating scored below 3 on no more than one of the five criteria, while those that received a B rating scored below 3 on two or more of the criteria. The study level and rating were combined to form a scale ranging from Level IA to Level IVB. Studies with better ratings were given greater weight when evaluating strategies for best practices.

Table 4: Criteria Used to Rate Methodological Issues Common to Falls Research

Are the individuals selected to participate in the study likely to be representative of the target population?
- 3 = Very likely to be representative
- 2 = Somewhat likely to be representative
- 1 = Not at all likely to be representative

What percentage of selected individuals agreed to participate?
- 3 = 80 – 100% agreement
- 2 = 60 – 79% agreement
- 1 = Less than 60% agreement or can't tell

Were the treatment and control group comparable at entry?
- 3 = Good comparability of groups or confounding adjusted for in analysis
- 2 = Confounding small, mentioned but not adjusted for
- 1 = Large potential for confounding or not discussed

Was ascertainment of falls and other outcomes reliable?
- 3 = Diary or active registration
- 2 = Interval recall
- 1 = Participant recall at the end of the study period

Indicate the percentage of participants completing the study. If the percentage differs by groups, record the lowest.
- 3 = 80 – 100% of participants
- 2 = 60 – 79% of participants
- 1 = Less than 60% of participants or can't tell

Studies scoring below 3 on zero or one criteria received an "A" rating. Studies scoring below 3 on two or more criteria received a "B" rating.

III. ISSUES REGARDING EVIDENCE FOR BEST PRACTICES

A. Background

When designing a fall prevention program, it is desirable to use strategies that are most effective for reducing falls and fall-related injuries. Although clinical judgment and anecdotal evidence can guide the selection of strategies, they lack the systematic collection of evidence needed to help accurately assess the effectiveness of a strategy for reducing falls. Therefore, one important source of information for guiding the selection of fall prevention strategies is the body of research that has used scientific methods to systematically evaluate the effectiveness of fall prevention strategies. However, the falls literature is comprised of thousands of articles, making it virtually impossible for most practitioners to collect, read, and synthesize all the necessary information.

Fortunately, an important tool to assist in the synthesizing of research exists in the form of literature reviews. Literature reviews serve to summarize and evaluate the research evidence pertaining to a certain topic. Recently, a special type of review, called the "systematic review" has become more popular for gathering and summarizing evidence, mainly because "they adhere to strict scientific design in order to make them more comprehensive, to minimize the chance of bias, and to ensure their reliability." (Deeks et al., 1996).

To date, there have been at least three systematic reviews that have examined the evidence for strategies to reduce falls among community-dwelling seniors. Two of the reviews were based on the results of literature searches conducted approximately five years ago (Gillespie et al., 2000; Deeks et al., 1996) and only examined studies that used a randomized controlled design. A third systematic review on the prevention of falls and related risk factors by the Australian National Ageing Research Institute (NARI) has been recently completed for both community-dwelling and institutionalized seniors (Hill, et al., 2000).

Although the NARI and current review are similar in that they examine the available research evidence for effective strategies in reducing falls and fall-related injuries among seniors, they differ somewhat in their focus and selection criteria. The current review focuses on providing information to help practitioners develop fall prevention programs based on best practices derived almost exclusively from evidence provided in studies that include falls or fall-related injuries as an outcome, and with this criterion, has included 18 studies that are not covered by the NARI review. The NARI review has less of an emphasis on defining best practices for practitioners, but includes an examination of research related to the reduction of risk factors that may not yet have been evaluated as a strategy for reducing falls or fall-related injury.

Because of its broader scope in the area of risk factors, it is recommended that practitioners planning on developing a fall prevention program also read the NARI review, in addition to the current review. Further, it should be noted that a recent systematic review has been published that focuses exclusively on the effectiveness of exercise programs for reducing falls among seniors (Gardner, Robertson, & Campbell, 2000). The current systematic review builds on these reviews by conducting an updated literature search (to the end of 2000) and including all research study designs.

B. Issues to Consider When Interpreting the Results of the Systematic Review

Inherent within any body of research are issues and limitations that must be considered when assessing evidence for best practices. These include limitations within the research design itself that affect confidence in the results as well as limitations that can affect the ability to generalize the information to other settings. Some of the most important issues that should be considered when reading and interpreting the results of this review are briefly summarized below.

1. Strategies Are Not Programs

To date, research in the area of falls prevention has typically evaluated individual strategies that are implemented and assessed over a limited time period. It should be emphasized that these strategies typically do not represent an entire program, but rather are one element to consider in the overall development of a fall prevention program. Many other considerations need to be taken into account when developing and implementing a fall prevention program, such as the population to whom the program is being directed, targeted risk factors, methods for delivering the program, available

resources, costs, barriers to implementation, participant compliance, and acceptability of the program by those receiving it. Consideration of these other factors is important, but most are beyond the scope of this best practices guide.

2. Reduction in Risk Factors Does Not Necessarily Lead to Reductions in Falls and Fall-Related Injuries

Although it would seem logical that reducing fall risk factors would result in a subsequent reduction in falls or fall-related injuries, this is not necessarily the case. For the majority of the biological, behavioural, environmental and social factors found to be associated with falls, the current state of research is only beginning to uncover sufficient evidence of the impact of risk factor reduction on the incidence of falls and fall-related injuries for community-dwelling seniors. For example, the findings by Tinetti et al. (1996) indicate a direct link between falling among older adults and changes in balance and changes in stride length. However, considerably more research must be done before the link between most factor reduction and changes in falls and fall-related injuries is adequately understood. For example, evidence is lacking as to what degree any particular risk factor must be reduced to produce a change in falls or fall-related injuries, the impact of reducing two or more risk factors simultaneously, and the interplay among risk factors in producing falls. Until such evidence is demonstrated, the link between the reduction of most risk factors and falls reduction remains too tenuous and uncertain to be able to use studies that only assess risk factor reduction as an indicator of best practices. With this in mind, only studies that include the reduction of falls or fall-related injuries as an outcome were included as evidence for best practices in this review. However, once a decision is made by those developing and implementing an intervention to target certain risk factors, it is appropriate and even recommended to then consider studies that indicate the best practices for reducing the selected risk factor.

3. Relation Between Falls and Fall-Related Injuries

Obviously, falls resulting in moderate or severe injury are the ones that are most necessary to prevent. However, it is difficult to obtain adequate sample sizes so that only the very largest studies are able to assess changes in the overall rate of injury-producing falls. Although it is expected that an overall reduction in falls would also be associated with a decline in fall-related injuries, there is little data to support this claim one way or the other. It has also been observed that there may be different or additional risk factors for falls that result in injury (King & Tinetti, 1996), further clouding the relationship between the reduction in overall falls and falls resulting in injury.

4. Defining Falls

In general, different studies use different definitions of falls, although they all usually have in common the idea of involuntarily landing on the floor, ground, or other lower surface. And though the issue of different definitions across studies may seem trivial, it is not when one considers that the definition of a fall can directly influence the conclusions drawn from a study. This potential is best highlighted by an example from a study that assessed the effectiveness of Tai Chi and computer balance training for reducing falls (Wolf et al., 1996). Two different definitions of falls were used that differed primarily in whether or not minor falls, such as stumbles were counted as a fall.

Using the more liberal definition resulted in almost twice the number of falls being recorded over the course of the study compared to using the more restrictive definition (209 versus 110). The implications of this discrepancy can be seen in the unadjusted risk ratios for falling. Despite having virtually identical risk ratios, the increased power due to a greater number of falls resulted in the risk for falling in the Tai Chi group to be significantly lower compared to a control group, when using the more liberal definition. However, the finding was non-significant using the more restrictive definition. This study, therefore, succinctly highlights the potential difficulties that can arise from the inconsistency in falls definitions used across programs.

5. Measuring Falls

Monitoring falls among seniors in a community setting requires some form of self-report. Self-reporting of falls is typically done in one of two ways, either by having participants recall whether or not they have fallen over a designated time period or through active registration, whereby participants contact the research team each time they fall. Having participants recall whether or not they have fallen leaves open the possibility of participants' forgetting about falls, particularly when asked to recall falling incidents over a long period of time. Active registration eliminates the problem of recall over long periods, but does require that participants remember and make the effort to contact the researchers after having experienced a fall. Further, regardless of the method of self-reporting, seniors may be reluctant to admit they have fallen. These limitations around self-report lead to the conclusion that reliance on self-report likely produces an under-reporting of falls in most research studies.

The results of the review indicated notable gaps in the literature pertaining to falls resulting in injury as an outcome measure, such as those concerning osteoporosis and the use of devices to reduce hip fractures. The absence of such studies is primarily due to the large numbers of participants required to show a significant difference as a result of any intervention. Among community-dwelling seniors, rates for fall-related fractures are approximately 5% and for hip fractures, as low as 1% (Scientific Advisory Board, 1996). Such studies typically focus on seniors at high risk of injury, such as those found in institutional settings.

6. Research Limitations

In interpreting the evidence for best practice, it is necessary to keep in mind that all research studies have methodological concerns that influence the confidence one can have in the results (internal validity) as well as their generalizability to other settings (external validity). As noted previously, some of the more important methodological considerations for falls research were evaluated for this systematic review, leading to a rating system to define how well studies were conducted. Studies with higher ratings should be given greater weight when considering research evidence than studies with lower ratings.

C. Resources for Practitioners

In addition to the evidence for the systematic review, a table of resources has been included to assist practitioners in accessing existing fall prevention program kits. Relevant information available through the Internet is also provided (see Appendix 2). These resources have not been scrutinized for accuracy of content with regard to fall prevention and are recommended for use at the discretion of the reader. Also included is an evaluation guide to assist programmers in identifying and measuring the goals, process and impact of their fall prevention initiatives (see Appendix 3).

D. Presentation of the Findings

Thirty-four studies were found that met the criteria for inclusion in this systematic review. Each of the studies was assigned to one of the following six categories according to the primary focus of the intervention: exercise, environment modification, education, medication, clinical intervention, and multi-factorial intervention. An additional category was included to address a major gap in the literature in a section entitled: Health Promotion Strategies: Promising Community Empowerment Approaches. It should be emphasized, that many interventions contain elements that cross one or more categories and thus their assignment may be viewed as somewhat arbitrary. Assignment to a particular category is not meant to discount the role of all elements of an intervention, but rather to allow comparison of interventions that have a similar primary focus or approach to falls prevention.

The evidence for best practices is organized into six sections delineated by each of the six categories of interventions noted above. For each section, we have provided a brief overview of the risk factors targeted by the intervention and the underlying logic of how reduction of the targeted factor would prevent falls and fall-related injuries. The studies are then briefly described and the major findings pertaining to best practices are highlighted. Further information for each study can be found in Appendix 1 or when extensive detail is required, the reader is encouraged to read the original studies themselves. Finally, based on the study results, a summary of recommendations for best practices is presented.

IV. EVIDENCE FOR BEST PRACTICES ON THE PREVENTION OF FALLS AND FALL-RELATED INJURIES AMONG SENIORS LIVING IN THE COMMUNITY

A. EXERCISE

As seniors age, they typically experience declines in physical functioning, including reduced strength, poor balance, increased body sway, and weakened skeletal structure. These types of decreases in physical function leave seniors vulnerable to experiencing increased falls and fall-related injuries. Therefore, it is reasonable to expect that interventions, such as exercises designed to reduce or reverse the effects of these declines in physical functioning, may be effective for preventing falls. This section examines

those studies where exercise was the primary strategy used to reduce falls. Eight studies were located that utilized only exercise as an intervention strategy and two studies were located that used exercise in conjunction with one other type of intervention.

Of the eight studies that used an exercise intervention only, four were judged as having inadequate power to detect a change in falls due to the intervention and thus are unable to provide evidence for exercise as a best practice for falls prevention (Kerschan-Schindl et al., 2000; Lord et al., 1995; Reinsch et al., 1992; Rubenstein et al., 2000). Of the four remaining studies, three demonstrated positive effects for reducing falls (Buchner et al., 1997; Campbell et al., 1997; Wolf et al., 1996) and one did not (Ebrahim et al., 1997). All three studies that showed a positive effect used a randomized control design, but differed in the type of exercise program offered.

After adjustment for fall risk prior to entering the study, Wolf et al. (1996) demonstrated that Tai Chi training (a form of Chinese martial arts) completed two times per week for fifteen weeks served to reduce falls by 47.5% among seniors 70 years and older compared to a discussion-only group. In the same study, weekly, computerized balance training over the same time period did not produce a reduction in falls. Buchner et al. (1997) introduced a program designed to increase seniors' strength and endurance. Their exercise program entailed having participants ride stationary bicycles and use weight machines three times per week over six months. Participants received training in either strength or endurance, or a combination of these. Compared to a non-exercising control group, participants in the three exercise groups combined were less likely to have fallen at least once over the one year follow-up (60% in the control group versus 42% in the exercise group).

Campbell et al. (1997) had an occupational therapist provide four home visits over a two month period to women 80 years and older to prescribe an individualized exercise program that included moderate intensity strengthening, balance, and range of motion exercises as well as encouragement to engage in brisk walking three times per week. Participants were also telephoned regularly to maintain motivation. Forty-three percent of the participants experienced at least one fall compared to 53% of the control group, and only 19% of the exercise group had multiple falls compared to 30% of the control group. The same exercise program was also found to be effective in reducing falls in a second study where the population was seniors taking, or withdrawing from, psychotropic medication (Campbell et al., 1999). In this study, after controlling for taking psychotropic medications and for falls in the year prior, there was a significant reduction in falls from .71 falls per person-year in the exercise group, compared to .97 falls per person-year in the non-exercise group.

Two exercise programs were identified that did not result in a statistically significant reduction in falls. Ebrahim et al. (1997) used a randomized controlled trial to test the effects of a brisk walking program on post-menopausal women who had sustained an upper arm fracture in the past two years. Participants were to take a brisk walk three times per week and were provided with quarterly follow-ups to discuss problems and reinforce the program. However, those who participated in the brisk walking program

experienced significantly more falls in the first year of the exercise program than non-exercisers, with no difference in falls in the second year. Reinsch et al. (1992), using a quasi-experimental design, examined the effects on falls of a low intensity exercise program three times per week to improve strength and balance and a cognitive-behavioural training program. Neither the exercise program nor the cognitive-behavioural training program either alone or in combination significantly reduced falls.

Overall, the evidence suggests that exercise can be effective in reducing falls among seniors. However, many questions still remain concerning how to optimize exercise programs to prevent falls. The programs reviewed varied in the type of exercises, level of intensity, and population targeted. Therefore, there is insufficient evidence at this point, to recommend one particular type of exercise program over another. The three studies that demonstrated a positive effect for reducing falls used three different types of exercise programs –Tai Chi (balance), strength and endurance, and a one-to-one individualized program. Further, the programs varied in their level of intensity in terms of the frequency of sessions, length of sessions, and difficulty of exercises. These differences indicate the potential of different types of programs for reducing falls, but more research is needed before a definite conclusion can be reached.

Finally, the study by Ebrahim et al. (1997) indicates that caution must be taken to ensure that adverse effects due to exercise are not experienced by seniors participating in such programs. It is not clear why the brisk walking program increased falls or whether it was just a chance result. In either case, this study points to the need of being aware of potential adverse effects of exercise programs.

Exercise Best Practices

- ***The evidence supports certain exercise regimes as an effective strategy for reducing falls.***
- ***Balance training was a component in most exercise programs where there was a statistically significant reduction in falls.***
- ***The use of Tai Chi exercises to enhance balance was the only effective strategy that was examined in isolation of other strategies.***
- ***More research is needed to determine which types of exercise programs are most effective for reducing falls.***
- ***More research is needed to determine which strategies are most appropriate for seniors with specific balance, strength or mobility problems.***
- ***Careful consideration is recommended when developing exercise programs as it is unclear what the optimal intensity level of exercise programs should be and at least one exercise regime has been shown to increase falls.***
- ***The effects of exercise strategies are often short lived without consideration for enhancing compliance over the long-term.***

B. ENVIRONMENTAL MODIFICATIONS

The study of environmental factors in the prevention of falls among community-dwelling seniors is an area of growing importance, as older people are living longer and remaining in their own homes rather than moving into institutions. Environmental modification of the home is the focus of four studies that met the inclusion criteria for this review, with all four reporting success in reducing falls (Cumming et al., 1999; Hornbrook et al., 1994; Plautz et al., 1996; Thompson, 1996). Many of the fall prevention initiatives using multiple strategies also include environmental modification as a component. However, the studies reviewed for this section are those that focus on understanding the contribution of environmental modification in isolation of other interventions. Environmental hazards targeted in the four studies included removing clutter; securing rugs and electrical cords; improving illumination; and installing handrails, grab bars, and nonskid strips.

An important element in the success of home modification strategies appears to be a component to ensure that identified hazards are actually modified. In the studies by Plautz et al. (1996) and Thompson (1996) that used a pre-post test design, intervention strategies included individuals going into seniors' homes to conduct environmental assessments and making the necessary repair or modification. The cost of the modification was either subsidized or free-of-charge. Thompson reported that 90% of the 4000 elderly people visited in their homes agreed to home modification and Plautz et al. stated that all subjects received some form of home modification. Plautz et al. (1996) reported a 60% reduction in falls from pre-intervention to post-intervention and Thompson (1996) reported a 58% reduction. Thompson (1996) also reported a 55% reduction in falls requiring medical attention over the 24 months from the pre-intervention to the post-intervention. All findings were statistically significant.

In contrast to the two previously described interventions where assistance was provided in making the home modification, participants in the intervention group of a randomized controlled trial designed by Cumming et al. (1999) implemented their own home modification, based on the recommendations of an occupational therapist. Funding sources were those typically available to seniors in the region who are clients of occupational therapists. Compliance with the recommendations varied. At a 12-month follow-up visit, compliance ranged from 19% for adding railings to external stairs to 75% for using a non-slip bathmat. The results of this study also showed a reduction of falls both inside and outside the home, indicating that it may not have been the home inspection and modification alone but rather that the routine occupational therapist assessment that accompanied the home assessment also had an effect. In another randomized controlled trial (Hornbrook et al., 1994), participants in the intervention group were assessed for home hazards and given fact sheets on how to obtain technical and financial assistance to make home modifications. Direct assistance was not provided in making the modifications. The findings showed only a 16% lower rate of falls among the intervention group compared to the control group, although this difference was

statistically significant after adjusting for age, gender, falls in the previous six weeks prior to the intervention, days hospitalized in the past year and chronic medical conditions.

Although the major focus of the four programs was home hazard modification, three of the programs contained additional components. Plautz et al. (1996) included counseling and information about risk factors due to home hazards. Hornbrook et al. (1994) included a safety booklet that identified common home hazards and classes to learn about environmental, behavioural, and physical risk factors and Cumming et al. (1999) included an occupational therapist assessment. Thus, it is not possible to positively state whether home assessment and modification by themselves reduce falling, or whether combining the home modification strategy with other fall prevention strategies enhance their effectiveness. In either case, though, it would appear that including home modification as part of a fall reduction program is an effective strategy for reducing falls.

One potential disadvantage of a home modification strategy to reduce falls is the cost of both materials and labour. Hornbrook et al.(1994) noted that about 62% of intervention households received financial assistance to make safety repairs. The average cost of project-subsidized modification or repairs was $78 (US dollars), over half of which ($46) was subsidized for participants. The most frequent modification involved installing bathtub grab bars and stair railings. It was also reported that virtually every household made modifications that required no expense, such as the removal of throw rugs. Plautz et al. (1996) utilized community resources, such as outreach workers and members of a youth training program, to conduct the home assessments and make modifications. Costs for materials averaged $92.80 (US dollars) per household and $50-100 for labour. Thompson (1996) indicated that the average cost to participants for his program was $41 (Australian dollars) and that the program itself cost approximately $60 per participant to operate.

Another issue requiring consideration is seniors' acceptance of home modification programs. For home modifications to be made, seniors must allow people into their homes for the initial home inspection and then allow their homes to be altered, including the installation of features that may change the appearance of their home (e.g., stair railings). Further, some safety features (e.g., grab bars) may also be perceived as indicators of frailty, a negative stereotype associated with the aging process. Plautz et al. (1996) indicated that they believed their link to the local health department, and the use of outreach workers – who were themselves seniors recruited from the same communities as the study participants – led to an increased acceptance of the program. Thompson (1996) noted that previous experience with a pilot program that attempted to advertise the home modification program through the media was ineffective, leading the researchers to spread the message in person at places where seniors were likely to gather and then ask seniors to sign up for the program. Word-of-mouth also became an effective advertising medium with satisfied participants informing their friends, who in turn asked for the program, a process which resulted in nearly half of the participants being referrals. The authors also indicated they believed that self-selection by seniors promotes success, as

participants were those who recognized their own risk of falling and wanted to change their environments.

The focus on the home environment of these four studies likely parallels the amount of time that elderly people spend in their homes compared to the time spend outdoors and in public environments. However, Reinsch et al. (1992) found that, among active healthy older adults, 51% of falls occurred while outside the home. Similarly, Gallagher and Brunt (1994) found that 65% of falls among seniors occurred outdoors while walking on a familiar route. These numbers indicate the need for more studies on the effectiveness of prevention strategies for settings other than private homes. However, it is challenging to evaluate this type of intervention; for instance, how do you isolate the combination of the prevention strategy in environments with multi-sources of stimulation; i.e. uneven surfaces, traffic noise, crowded or obstacle-ridden sidewalks? Prevention approaches in the public environment also require the involvement of multiple stakeholders to address the wide variety of potential hazards, including city planners, road engineers, public works officials, transportation services, businesses, and government departments that set public safety standards and building code regulations. Under-evaluated, but promising strategies concerning outdoor risk modification will be addressed later in this report.

Environmental Modification Best Practices

- ***The evidence suggests that including home modification as part of a fall reduction program is an effective strategy for reducing falls among seniors.***
- ***To enhance home modification programs, combine with strategies such as education and counseling about reducing risks—especially the risks that increase falls when environmental factors also play a role.***
- ***Successful home modification programs include those with financial and/or manual assistance in completing the modifications.***
- ***Occupational therapists' training and skills make them ideal professionals for conducting home assessments, as they are able to assess both the senior's environment and their ability to function within that environment.***
- ***Success and cost effectiveness of environmental strategies are enhanced by targeting those who are ready for change.***
- ***Readiness for environmental modifications may be linked to having had a recent fall, and/or an increased understanding of the risks and prevention strategies.***

C. EDUCATION

The goal of educational strategies is to increase awareness of the potential consequences of falling and to enhance knowledge about strategies for prevention. Five studies were located that use an education intervention to increase seniors' awareness of the risk of falls and modification strategies. Four of these studies, however, were based on small sample sizes, making it impossible for them to have adequate power to detect significant changes in falls (Abreu et al., 1998; Alkalay, Alcalay, & Sherry 1984; Ryan & Spellbring, 1996; Schonefelder & Van Why, 1997). Most interventions included a

lecture component, time for questions and discussion, and the distribution of print materials. All four studies used group education sessions. Abreu et al., (1998) also compared conveying the information through both group and home visits. Alkalay, Alcalay, and Sherry (1984) included individual sessions with family physicians and nurses that addressed the importance of reducing non-essential drug intake, especially tranquilizers and sleeping pills. Three of the four studies delivered the information in a single session, typically 1 to 1½ hours in length (Abreu et al., 1998; Alkalay, Alcalay, & Sherry 1984; Ryan & Spellbring, 1996) and one study (Schonefelder & Van Why, 1997) delivered the information over three sessions. Although, as noted, none of the studies had adequate sample sizes to properly evaluate the effects of the interventions, Alkalay, Alcalay and Sherry (1984) indicated a drop from 24.3% for falls in the six months prior to the intervention to 6.8% for falls in the six months following the intervention. Further, the authors reported a considerable reduction in the use of tranquilizers and hypnotics, although these changes were not quantified.

Robson et al. (unpublished manuscript) tested a two-session group education program, called Steady-As-You-Go (SAYGO), using a randomized control trial of 571 participants. Both sessions were 90 minutes in duration. The first 90-minute session had participants learn about falling risks and complete a self-assessment of risk for falls related to their own behavioural, physical, and environmental risk factors. Participants were urged to reduce their risk factors and were given tips to do so, including distribution of printed materials and an exercise video. The second 90-minute session, conducted approximately one month after the first, was primarily social in nature, allowing participants to share their experiences and to support one another. These educational strategies were based on the principles of social learning theory including valuing shared learning among peers and peer modeling for change. Among participants who received the intervention, reductions were made in seven out of eight risk factors. During the four-month follow-up period, 17% of the intervention group versus 23% of the control group fell, although this difference did not reach statistical significance. However, a sub-group analysis among those who had fallen in the year prior to the intervention did reveal a significant difference in falls, with control group participants twice as likely to fall as those who received the intervention.

Although there is inadequate evidence to determine whether education strategies by themselves can serve to reduce falls and fall-related injuries, they may play an important role in multifaceted fall prevention initiatives. Seniors unaware of the risks of falling are unlikely to be motivated to adopt fall risk reduction strategies that are part of multifaceted interventions. Similarly, seniors need to have some knowledge of the risk factors for falling and means to reduce these risk factors in order to be active participants and change agents in modifying risk factors to reduce falls. Thus, there is likely a role for education strategies that can effectively increase seniors' awareness and knowledge of falls and fall risk factors as a component of multifaceted interventions.

Education Best Practices

- ***There is little evidence whether or not education programs alone are effective in modifying fall risk factors or are effective in reducing falls or fall-related injuries.***
- ***Education strategies may play an important role in multifaceted risk reduction strategies to increase seniors' awareness and knowledge of falls risk factors, thereby making them more willing to adopt strategies to modify fall risk factors.***
- ***The reduction of falls in one study may have been due in part to the use of theoretical models for adult learners such as valuing shared learning among peers and peer modeling for change.***

D. MEDICATIONS

The literature presents two different perspectives regarding behavioural change around medication use. The first addresses reducing or eliminating the use of medication associated with an increased risk of falling, such as psychotropic medication. A second approach advocates using of certain medications to reduce the risk of falling or of sustaining a fall-related injury. This includes targeting individuals who could benefit from the use of medication to strengthen muscles or bones.

The class of drugs most linked to an increased risk of falling among seniors is benzodiazepines (Koski et al., 1996; Neutel, Hirdes, Maxwell, & Patten, 1996; Oster et al., 1990; Ray, Griffin, & Malcome, 1991; Ray et al., 1990). Used for the treatment of anxiety or insomnia since 1962, benzodiazepines (including sedatives and psychotropic drugs) are among the most widely prescribed class of drugs for people aged 65 and over (Neutel et al., 1996; Oster et al., 1990). Yet recent studies show that their use impairs both cognitive performance and psychomotor skills (Oster et al., 1990). However, few studies have been conducted that demonstrate a reduction in falls or fall-related injuries when seniors stop taking these drugs. This may in part be due to the difficulty in compliance with changes to drug regimes.

Numerous studies refer to educating seniors about the increased risk of falling due to taking certain drugs. However, only one study was found that focused on reducing psychotropic drug use as a method for reducing falls. In this double-blind, randomized control trial by Campbell et al. (1999), patients who were taking psychotropic medication were assigned to one of four groups, psychotropic medication withdrawal plus a moderate intensity home exercise program, psychotropic medication withdrawal only, home exercise program only, or no change in psychotropic drug medication and no exercise program. After controlling for a history of falls in the previous year and the total number of medications taken, the relative hazard for falls in the medication withdrawal group was significantly reduced (by 66%) compared to the non-withdrawal group. However, these results should be interpreted with caution, as it is not certain what role the exercise program may have played, although the authors did note that no interaction effect was found between the two interventions. Further, the results are based on a relatively small sample size, which the authors indicate should be thought of as a pilot study. A challenge

in psychotropic drug withdrawal is achieving permanent withdrawal. Only 17 out of 48 participants in the medication withdrawal group took the placebo capsules for the full final 30 weeks of the trial, and of those 17, eight started taking psychotropic medication again within one month of completion of the study.

In another randomized controlled trial with falls as an outcome measure, the effect of medication use on muscle performance and balance was examined by comparing taking oral hormone replacement therapy plus calcium, versus taking calcium alone (Armstrong et al., 1996). Post-menopausal women (45-70 years) who had suffered a wrist fracture within the previous seven weeks were assigned to take oral hormone replacement therapy plus calcium or just calcium. However, the hormone replacement therapy did not show an increase in muscle performance, improved balance, or a reduction in falls over a one-year period.

Bone loss and weakened skeletal structure has been shown to be associated with fall-related fractures (Scientific Advisory Board, 1996). The mechanisms most likely to be involved in bone loss among seniors is lack of exercise, low dietary intake of calcium and vitamin D, as well as a lack of sun exposure. However, in a recent review of over 35 randomized clinical trials of treatments to increase bone density (Meunier, 1999), only two were found to clearly demonstrate decreased fracture rates. A randomized controlled trial on the use of bisphosponate alendronate among women with existing vertebral fractures (Black et al., 1996) and another on the use of a combination of Vitamin D3 plus calcium among elderly women (Chapuy et al., 1992) showed fracture reductions of 51% and 27% respectively. However, these studies did not meet the criteria for this review as the outcomes were not limited to seniors or to fall-related fractures, and the study of Vitamin D3 targeted seniors in both community and institutional settings.

Medication Best Practices

- ***Taking medications from the class of drugs known as benzodiazepines is shown to increase the risk of falling among seniors.***
- ***The evidence appears to support psychotropic drug withdrawal as a means to reduce falls but more studies are needed on the practical application of this strategy.***
- ***Compliance is an important consideration in psychotropic medication withdrawal as it appears difficult for psychotropic drug users to stop, and clinicians may need to consider alternative treatments for anxiety and sleep disorders to enhance compliance.***
- ***There is a possibility that medications to improve physical functioning may reduce falls, but the one study that examined hormone replacement therapy to enhance muscle strength and improve balance failed to produce a change in falls.***
- ***Taking vitamin D3 and bisphosponate alendronate have been shown to reduce the risk of sustaining a fracture among women. However, no studies were found targeting community-dwelling seniors that establish a link between fall-related injuries as an outcome and the use of medications to enhance bone density.***

E. CLINICAL INTERVENTIONS

Clinical intervention for falls prevention is primarily those based on a systematic assessment of an individual by a health practitioner, where the purpose of the assessment is to identify and lessen physiological factors found to contribute to the risk of falling or sustaining a fall-related injury. Thorough, routine, clinical assessments are indicated for all seniors, given the strong association between falling and pre-existing medical conditions commonly found among older adults. Such conditions include those that adversely affect gait, balance, muscle strength, bone density, cognition, hearing, vision, and touch (Rubinstein et al., 2000). Clinical assessments are particularly important following a fall as they often uncover undiagnosed health problems that may contribute to the risk of future falls (Rubinstein, 2001).

Studies focusing on clinical assessments to reduce falls covered a variety of strategies including intervention implemented by emergency room nurses and physicians (Baraff et al., 1999; Close et al., 1999), clinical assessments conducted at health centres (Wagner et al., 1994), and in-home assessments conducted by trained health professionals (Gallagher & Brunt, 1996; Fabacher et al., 1994; Weber & Kehoe, 1996) or by untrained volunteers or health visitors (Carpenter et al., 1990; Vetter, Lewis & Ford, 1992).

Of the eight studies where clinical assessments were a key component for falls prevention, four had insufficient power to detect a change in falls (Baraff et al., 1999; Fabacher et al., 1994; Gallagher & Brunt, 1996; Weber & Kehoe, 1996). However, for some, positive behaviour changes based on the clinical assessments make them worthy of mention (Gallagher & Brunt, 1996; Fabacher et al., 1994).

Intervention implemented by emergency room nurses and physicians was the focus of the randomized controlled trial by Close et al. (1999) to determine whether a structured bi-disciplinary assessment of elderly people who attend an emergency department with a primary diagnosis of a fall could decrease the rate of further falls. A detailed medical examination was conducted for the 184 intervention group patients, with appropriate referrals made for relevant services (the 213 control group members received usual care only). The examinations revealed a range of health and physical functioning concerns including cardiovascular disorders (26 patients), visual impairments (98 patients), decreased leg power (42 patients), peripheral neuropathy (30 patients), inability to stand on one leg with eyes open for more than 10 seconds (109 patients), cognitive impairment (51 patients), and scores of greater than five on the geriatric depression scale (28 patients). Following discharge, a single home visit was undertaken by an occupational therapist to assess physical function and home hazards. Fall prevention advice and education was provided, and minor home modifications were made with the patient's consent, with minor equipment supplied directly by the occupational therapist. Referrals were made for larger repairs or equipment. The findings of this study demonstrated significantly fewer falls in the intervention group over one year compared to the control group, with 32% of intervention participants versus 52% of control group participants reporting at least one fall.

Clinical assessments conducted at a group health cooperative by nurse educators trained in fall risk assessment and prevention were also found to be a successful strategy in reducing falls and fall-related injuries in a 36-month randomized trail of 1559 seniors (Wagner et al., 1994). However, this clinical assessment was a one-time intervention with little follow-up, and the significant reduction in falls and fall-related injuries noted at the end of the first year diminished during the second year follow-up to non-significant levels. Features of this intervention that likely contributed to the reduction in falls and related injuries include the combined effects of the qualifications of the clinical assessor, thorough screening for physical and behavioural risk factors, and the individually tailored follow-up strategies to address identified risk factors. Prevention options included fitness tests and a two-hour exercise orientation session, screening and treatment referrals for alcoholism, home safety inspections by trained volunteers, pharmacy-generated reviews of drug profiles, referrals for correctable vision or hearing problems, behavioural intervention classes for those with untreatable hearing problems, and community supports for those with untreatable vision problems.

In-home assessments by nurses were a feature of studies by Gallagher and Brunt, (1996) and Fabacher et al. (1994). In the study by Gallagher and Brunt (1996), all subjects received a baseline and six-month interview, as well as follow-up telephone calls to obtain the details for all falls reported over the six months. Those in the intervention group received two additional nurse visits for comprehensive personal and home risk assessments, an educational video, and follow-up recommendations for prevention strategies. No significant reduction in falls occurred between the intervention and control groups. However, when the control and intervention groups were considered together, the average number of falls was reduced by 30%, fear of falling decreased, and there was an overall significant increase in the utilization of health services. A similar increase in the use of health services was also reported by Fabacher et al. (1994) following in-home nurse assessments for fall risk that resulted in 63% of participants obtaining a hearing evaluation and 83% obtaining an eye examination. Fifty-four percent also reported an increase in their physical activity and 71% made modifications to their home to reduce the risk of falls. However, as with the Gallagher and Brunt (1996) study, there were no significant differences in falls between the intervention and control group over the twelve-month follow-up period. Possible explanations for the inability to detect a reduction in falls for these two studies may be related to the small sample sizes, and in the Gallagher and Brunt (1996) study, the short follow-up time of six months, which may be inadequate to detect a difference based on clinical intervention. For example, a new prescription for corrective eye wear will enhance vision over the long-term but in the short-term may contribute to risk as the person adjusts to new glasses, particularly those containing bifocal or trifocal lenses.

In-home clinical assessments conducted by volunteers through the administration of activity of daily living questionnaires, followed by regular visits and referrals to general practitioners, were also found to be effective strategies in reducing falls (Carpenter et al., 1990). In addition to a significantly lower number of falls among the intervention group compared to the control group, the intervention group was also less likely to be admitted to long term care facilities and more likely to receive community support services sooner.

However, a similar strategy tested by Vetter, Lewis and Ford (1992) using health visitors to identify risk factors for falling did not show a reduction in falls. The frequency of visits varied based on client need. Specific factors that were targeted includes dietary intake, heart problems, medications, and home hazards. Appropriate referrals were made based on assessed findings. Participants with moderate disabilities were encouraged to attend fitness classes run by a physiotherapist in the local housing complex. The authors of this study speculate that the increased exposure to exercise among participants may have actually contributed to the risk of falling.

Clinical Intervention Best Practices

- ***Clinical assessments by nurses or physicians appear to be an effective strategy in reducing falls and related injuries but these effects have not been assessed in isolation of other strategies.***
- ***One study found that over half of the emergency room patients admitted for fall injuries had balance deficits and visual impairments.***
- ***For seniors who have sustained a fall, a thorough medical assessment should be conducted for underlying physical or cognitive contributors to the fall.***
- ***Screening for physical and cognitive impairments that contribute to falling appears to be effective when combined with interventions to reduce behavioural and environmental risk factors associated with falling.***
- ***The skills of occupational therapists, or nurses trained in fall risk assessment and prevention, were used following clinical assessments to determine the best supports to enhance physical functioning within the senior's home and community environment.***
- ***One study indicates that initial screens may be conducted by trained volunteers, supervised in the use of reliable risk assessment questionnaires, providing referrals are made to the appropriate health or social service providers.***

F. MULTI-FACTORIAL INTERVENTIONS

Falls are often the result of a complex, interdependent constellation of factors, resulting in multiple causes acting together to produce a fall. Therefore, interventions that seek to reduce falls through multiple strategies make sense.

The literature search revealed seven studies that primarily adopted a multi-factorial approach to reducing falls and fall-related injuries. Three of these studies targeted whole communities, with strategies designed to have a wide reach across an entire city or municipality (Kempton et al., 2000; Poulstrup & Jeune, 2000; Ytterstad, 1996). The other four studies used intervention strategies at the individual level. Three included assessing individuals' risk based on a wide range of factors and developing multiple, individualized intervention strategies to reduce risk factors particular to each individual (Bezon et al., 1999; Tinetti et al., 1994; Wolf-Klein et al., 1998). The fourth study attempted to modify a wide range of risk factors without targeting a specific group (Steinberg et al., 2000).

One of the three community-wide, multi-strategy intervention projects was conducted over four-years in Australia by Kempton et al. (2000). The interventions targeted knowledge, attitudes, behaviours and risk factors including chronic conditions, footwear, vision, physical activity, balance and gait, medication use, and home and public safety hazards (Kempton et al., 2000). Population-level approaches included offering classes on gentle exercise; falls awareness and medication use; the distribution of a booklet on fall risk factors and prevention; workshops; home safety checks; and television, radio and newspaper advertisements. After controlling for age and gender, there was a non-significant reduction of 22% in the number of falls in the intervention area compared to the control area. However, there was a significant 20% lower, age-standardized rate for fall-related hospital admissions in the intervention area, relative to the control area.

Poulstrup and Jeune (2000) conducted a similar study in Denmark comparing fall-related fractures among seniors in municipalities receiving multiple interventions to those designated as control regions. Strategies for prevention included training for all district nurses, general practitioners and home helpers on the identification and management of falls among the elderly. In addition, all the elderly in the region were provided with information on risk factors through mailed leaflets and talks in seniors' centres. Home visits by health providers were also provided for targeted high-risk groups to identify and reduce risk factors. Findings show a 14% non-significant reduction of all fracture types for all seniors. However, when women were considered as a sub-group, a statistically significant reduction of 46% was found for lower extremity fractures and a non-significant reduction of 43% was found for hip fractures. The reductions were highest among women who were living alone. There were no reductions found among men. The third community-wide study, conducted by Ytterstad (1996) in Norway, also showed a significant reduction in fractures resulting from falls (26.3% reduction over five years). Strategies included the formation of an injury prevention coalition of hospital, public and private organizations. Interventions implemented included health fairs; media campaigns; and home visits to promote environmental safety, healthy diet and lifestyle, and a

reduction of inactivity and isolation. Special stations were established for health consultations for seniors, fitness classes were offered, safety equipment and home modifications were subsidized, and during the winters, sand was delivered to homes for gritting driveways and stairs.

Success in reducing falls was reported in all three studies that used a multi-factorial risk assessment to first identify an individual's risk factors for falling and then design an individualized intervention based on the assessment. In a well-conducted, randomized controlled trial by Tinetti et al. (1994), nurse practitioners and a physical therapist conducted in-home baseline assessments of physical, behavioural and environmental risk factors for falling. Based on these assessments, participants received three months of interventions including recommendations to reduce hypotension, education about sedative-hypnotic agents, review of medications with a primary physician, training in transfer skills in the bathroom, alterations to bathroom equipment, removal of home hazards and installation of safety devices, gait training and use of assistive devices, and exercises for balance and strength. After the intervention phase, staff phoned participants monthly for the following three months to monitor overall progress for the following three months, and adherence to the exercise program was monitored weekly by the physical therapist. Compared to a control group that received social visits only, at four and a half months after baseline, a significantly smaller percentage of the intervention group continued to use at least four prescription medications, to transfer unsafely to bathtub or toilet, or to have impairment in balance or gait. Compared to control participants, participants who received an intervention differed significantly in the time of their first fall, in the number of people who fell (35% of the intervention group versus 47% of the control group), and in total number of falls (94 versus 164).

A study by Wolf-Klein et al. (1988) targeted high-risk seniors with a prior history of falling. Multidisciplinary health care team members conducted thorough assessments for possible causes of falling and interventions based on these assessments were put in place, including the medical management of health problems, home environment adaptations, and education around appropriate equipment and fall precautions. Follow-up was included whenever necessary. Prior to the study, all of the 36 participants had fallen at least once in the previous year and 50% had fallen monthly or more frequently. In the year following the intervention, only 22.3% had experienced a fall. Seventeen percent continued to fall but less frequently. In the final study using assessments of individual risk factors, Bezon et al. (1999) reported on the implementation of a fall prevention project targeting low-income patients of a nurse-managed primary care clinic. Participants were assessed for their risk of falling using a risk assessment tool. Those identified as high risk for falling received an intervention directed toward their identified risk factors including the control of chronic disease, medications, healthy lifestyle (diet and exercise), visual and hearing difficulties, physical activity prescriptions, education, removing environmental hazards, exercise programs, footwear, and teaching how to get up after a fall. There was a large reduction in falls from the year prior to the intervention, when 30 individuals (26%) had fallen, compared to the year following the intervention, during which only 4 (3%) fell.

Steinberg et al. (2000) examined how adding components to a multi-factorial intervention affects falls prevention among a general population of seniors. There were four interventions, each of which built on the previous. The first group received only education through an oral presentation, a video on home safety, and a pamphlet on falls risk factors and prevention. The second group received the same intervention as the first, plus a one-hour exercise class, exercise handouts, and an exercise video. The third group received the same intervention as the second group plus a home safety assessment with financial and practical assistance to make home modifications. Finally, the fourth group received the same intervention as the third plus a clinical assessment and advice on medical risk factors for falls. There were no differences in falls between the groups, although the number of reported slips and trips were significantly higher in the education only group compared to the other three groups.

The reviewed comprehensive multi-factorial programs indicate their effectiveness for reducing falls and fall-related injuries among seniors. However, there are at least two important considerations when developing a multifaceted falls prevention program. First, such programs tend to be costly and require a large amount of resources. For example, Tinetti et al. (1994) estimated that their intervention cost $891 (US dollars) per participant and all the multi-factorial interventions that produced a significant reduction in falls or fall-related injuries required a time commitment from many health professionals.

The second consideration when developing a multi-factorial program is selecting what risk factors should be targeted. As a specific example, more research is required to examine the interaction effects of changes in health status and environmental contributors. Unfamiliar or unsafe environments can increase the risk of falling for persons who have problems with balance or mobility. Physical conditions, such as the effects of a stroke and partial blindness, may not be subject to change. However, the addition of handrails on stairs can steady the balance of a person with one-side paralysis, and good lighting can enhance vision for many with partial loss of eyesight.

Unfortunately, there is virtually no research that examines the most effective combination of risk reductions strategies for reducing falls and fall-related injuries nor the interplay between multiple risk reduction strategies. However, there is potential to explore these issues as demonstrated in a study by Tinetti, McAvay, and Claus (1996) that used multivariate analysis to examine the impact of the individual risk reduction strategies that made up their multi-factorial intervention (Tinetti et al., 1994). Their multivariate analysis demonstrated that a decline in a risk factor targeted by a particular component of the intervention was associated with a decline in the occurrence of falls, holding all other risk factors constant.

Multi-Factorial Best Practices

- ***A number of studies indicate that multiple strategies directed at a wide range of risk factors are effective in reducing falls and fall-related injuries.***
- ***Multidisciplinary teams of heath practitioners trained in the detection and prevention of fall risk factors are necessary to address the complex combination of factors that contribute to falls among the elderly.***
- ***Effective outcomes may require a combination of strategies such as subsidies for home modifications and safety equipment, and accessible health and social services tailored to the safety needs of seniors at risk—such as the delivery of sand in winter months to isolated seniors.***
- ***More research is needed to understand the contribution of specific strategies in reducing falls and related injuries and the potential benefits of combinations of strategies.***
- ***Education strategies may play an important role in multifaceted risk reduction strategies to increase seniors' awareness and knowledge of falls risk factors, thereby making them more willing to adopt strategies to modify fall risk factors***
- ***Dissemination of information to large groups may be best conducted through multiple strategies such as mass media, workshops, classes, and meetings held in local seniors' centres.***

G. HEALTH PROMOTION STRATEGIES: PROMISING COMMUNITY EMPOWERMENT APPROACHES

Studies found through criteria established for this systematic review failed to include a number of fall prevention initiatives that show promise. Reasons for exclusion of these studies include a lack of empirical testing or because the outcome measures did not include a reduction in falls or fall-related injuries. A number of the initiatives in the promising studies reflect a "bottom up" orientation to prevention, based on a community empowerment approach to health promotion. This approach differs from most of the approaches described so far, where prevention programs were typically pre-designed and packaged for delivery by health professionals using a "top down" orientation and the users of the programs tend to be passive recipients.

Through a community development approach, involvement includes a broad range of individuals and organizations in the design and implementation of fall prevention strategies. Such an approach has the potential for the development of a wider scope of prevention strategies that reflect the role of social, economic and cultural determinants of health. The multiple factors associated with falls point to a need for a multidisciplinary, community-wide approach to finding solutions. Involvement of multiple stakeholders has the potential to facilitate and significantly enhance the success of prevention initiatives. A key component of a community development approach involves developing successful partnerships. Potential partners for prevention of falls and related injuries among older adults include seniors themselves, social service workers, faith groups, advocacy groups, business people who serve seniors, health promotion and health

education personnel, pharmacists, community members, product designers (architects, urban planners, developers), and government officials (Gallagher & Scott, 1997). Adopting a community development approach involving a variety of partners in both the planning and implementation stages has the advantage of increasing local acceptance and commitment, accessing knowledge and expertise (particularly around local community issues), gaining additional resources, and increasing community capacity. Some of these advantages can be seen from two examples of Canadian programs that aimed to increase community involvement in fall prevention activities.

Examples of programs using a health promotion approach for falls prevention are those by Edwards and colleagues (Edwards & Aminzadeh, 1998) and Gallagher and Scott (1995). These examples were selected based on the authors' knowledge of these programs, and not through the results of a systematic search, as used for the identification of prior strategies.

The program by Edwards and colleagues (1998; reported in Gallagher, Scott, & Mills, 1999) focused on collective care capacity and action. Edwards and her staff went into apartment buildings and mobilized residents' interest and action around falls prevention. They selected residents to be community organizers, worked with them on skills training (lobbying, social marketing, changing behaviour) and content training (risk factors for falls), and developed an action plan within their building. Involving residents in this program required staff to be open to residents' perceptions of the need for falls prevention and to expand connections within the building through those who were ready to move ahead. It was also recognized that there was a need to identify and develop community organizers within each building. Finally, nurses working with building residents had to learn to build on issues and concerns identified by the residents themselves and to use these to create opportunities for falls prevention.

The fall prevention project titled, *Studies to Promote Environmental Safety (STEPS)* by Gallagher and Scott (1997) had as its goal the creation of safer environments for those at risk for falling by increasing awareness about the causes of falls in public places, increasing the likelihood of the elimination of identified hazards, and assisting in the developing of risk management plans to reduce hazards. After consulting with key stakeholders (including individuals and organizations representing seniors and persons with disabilities, government officials from transportation and health sectors, politicians, architects, building owners and managers, and health and social service workers), STEPS sponsored a hotline for nine months so that people could report falls. Information from the hotline was relayed to building managers and appropriate municipal officials. The actual rate of repairs was not determined, but unofficial feedback from those to whom hazard information was reported indicated that about one-third were repaired and many hazards were marked with orange fluorescent paint to draw attention to the hazard. Further, STEPS hosted a symposium that brought together health care professionals, engineers, city planners, politicians, and others with a mandate for public safety to discuss the study findings and to compile recommendations. One recommendation that resulted from the symposium was that municipalities and private building owners develop a plan to prioritize repair of uneven and slippery surfaces on sidewalks and other

walkways, and to develop clear mechanisms for reporting hazards (reported in Gallagher, Scott, & Mills, 1999). One result of the STEPS project was greater awareness on the part of municipal engineers. For example, the municipal engineer for one community described changes in his perceptions of city design that resulted from his participating in STEPS. He indicated a realization that most designs have been based on a mythical average person who is male, between 20 and 40 years of age, very fit, and with good eyesight. Further, the same individual indicated a greater awareness of common public hazards including broken asphalt, obstacles on public walkways, and pedestrian islands. Such an understanding by a municipal engineer is important because s/he is in a position within the community to initiate positive changes.

Health Promotion Approaches to Best Practices

- ***Community-based strategies allow for multifaceted approaches.***
- ***Seniors are key participants in the design and implementation of community-based strategies.***
- ***The involvement of multiple stakeholders has the potential to facilitate and significantly enhance the success of prevention initiatives.***
- ***Fostering partnerships among stakeholders increases local acceptance and commitment; accesses local knowledge, expertise, and resources; and increases community capacity.***

V. ISSUES FOR FURTHER RESEARCH

This review highlights studies that have demonstrated significant reductions in falls through the implementation of individual and multifaceted approaches. Other promising strategies have also been highlighted. However, the field of fall prevention research is relatively new and there is much more research required before we can begin to understand which strategies are best suited to which seniors and which strategies will prove most effective over the long-term. Beyond the research required to identify effective strategies for fall and fall-related injury reduction, other important questions need to be addressed around fall prevention program development and delivery. Briefly described below are three of these issues: the target population, program acceptance, and compliance.

A. Target Population

The target audience can influence both the content and delivery of fall prevention programs. Seniors are a large and diverse group making it unlikely that one set of strategies for falls prevention will apply to all. A gap noted in the literature review is the lack of research on the effectiveness of prevention strategies based on culture, race, gender or socioeconomic status. Acceptance and effectiveness of strategies may also be influenced by whether or not the senior lives in an urban or rural community. Barriers to implementing prevention strategies may arise from illiteracy, poverty or social isolation.

For example, a senior who lives in poverty and has no means of transportation is unlikely to benefit from exercise classes offered across town.

B. Seniors' Acceptance of Fall Prevention Programs and Intervention Strategies

Fall prevention strategies often involve behavioural change or changes to a senior's environment, requiring accepting of these changes by seniors. However, little research has examined means by which barriers to seniors' acceptance of programs can be reduced. For example, ageism and negative stereotyping make it difficult to promote prevention strategies such as seeking help with housework or shopping, wearing sensible shoes, using assistive devices, allowing home modifications, or even participating in fall prevention programs at all. Many seniors, regardless of their chronological age, do not want to be viewed as old, frail or vulnerable to injury. Anticipating and designing programs to reduce the barriers owing to ageism and stereotyping are likely to increase seniors' acceptance. As an example, a recent study of seniors' perceptions of fall prevention strategies indicated that interventions would be more readily accepted if the emphasis were put on remaining independent longer rather than needing an assistive device (Commonwealth Department of Health and Aged Care, 2000). Interventions least likely to be accepted included having medications reviewed, having foot and eyesight checks, changing the type of footwear worn, and asking for help with daily tasks such as shopping and housework. Strategies such as finding out more about falls, speaking with physicians about falls, and participating in fall prevention programs, were seen as new and unfamiliar concepts by most seniors, and accepted with some reservations. The same study also emphasized the importance for seniors to be in control of their life, to be free and to live in their own homes for as long as possible.

C. Compliance With Recommended Strategies

A major challenge in the implementation of fall prevention programs is participant compliance with recommended prevention strategies. The benefits of strategies, such as exercise, can only be conferred upon seniors who actively participate in the program on a regular basis. Therefore, to optimize the effectiveness of strategies, such as exercise, not only must the physiological aspects of the component be effective, the program itself must be delivered in such a way as to motivate participants to continue engaging in the fall prevention strategy. Although some of the studies reviewed reported compliance rates, there was little mention of theory, research, or strategies put in place to ensure high levels of adherence.

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APPENDIX 1:
Summary of Systematic Review

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Exercise Interventions				
Buchner et al. (1997) US	To determine if strength and endurance training can modify risk factors for falls and have a beneficial effect on falls and health services use. ***Population group:*** Older adults enrolled in a large HMO (mean=75 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** I A	***Intervention 1***: Endurance training one hour 3 days per week for 24-26 weeks (n=19). ***Intervention 2:*** Strength training one hour 3 days per week for 24-26 weeks (n=20). ***Intervention 3:*** Endurance and strength training one hour 3 days per week for 24-26 weeks (n=22). ***Control***: Instructed to maintain usual activity levels (n=29).	▪ In the year after randomization, 42% of all exercise participants combined reported a fall compared to 60% of control participants. There was a significant beneficial effect of exercise on time to the first fall (relative hazard = 0.53, p<.05). A person-time analysis revealed exercise participants had fewer total falls during follow-up. The fall rate in exercise participants (.49 falls/year) was significantly lower than the fall rate in controls (.81 falls/year) (RR = 0.61, p<.05). ▪ Participants in the exercise groups showed significant gains in strength and aerobic capacity.
Campbell et al. (1997) New Zealand	To assess the effectiveness of a home exercise program of strength and retraining exercises in reducing falls and injuries in elderly women. ***Population group:*** Women 80+ (mean=84 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** I A	Four home visits by a physiotherapist over two months to prescribe exercises and a walking plan. Participants were encouraged to complete their exercises and walk at least three times per week. Participants telephone regularly to maintain motivation (n=103). ***Control***: Four home visits by the research nurse over two months that were social in nature. Participants also telephone regularly (n=110).	▪ At one-year follow-up, significantly lower rate of falls in exercise group (88) than control group (152) (0.87 vs. 1.34 falls per person year, hazard ratio=0.68 p< .05). 46% of exercise group experienced at least one fall versus 53% of control. 19% of experimental group had multiple falls versus 30% of control group. Hazard ratio for a first fall with injury was 0.61 (p< .05,) and the proportion of participants monitored for the full 12 months (n=213) who were injured from a fall was lower in the exercise group (26.2%) than in the control group (39.1%) (hazard ratio=0.67, p<.05). ▪ After six months, exercise group showed significant improvement in balance performance in the chair stand test as compared to controls.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Ebrahim et al. (1997) UK	To examine whether brisk walking increases the bone mineral density of the femoral neck, reduces the number of falls experienced, or reduces the rate of spinal fractures. ***Population group:*** Postmenopausal women who had sustained an upper arm fracture in the past two years (mean=67.2 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 24 months ***Power Rating*** = 3 ***Level*** I B	Brisk walking exercise 40 minutes three times per week (n=49). ***Control***: Upper limb exercises (n=48).	• In first year, women in walking group reported more falls than in control (80.1 vs. 52.0 falls per 100 person-years, $p < .01$). • In year two, no difference in fall rates between walking and control (59.2 vs. 58.3 falls per 100 person years, ns). • The number of fractures was small, and similar, between groups (year 1, 2 vs. 3; year 2, 4 vs. 1 for walking and control groups, respectively). • No differences in risk factors between groups except walking group had better physical stamina than control group.
Kerschan-Schindl et al. (2000) Austria	To determine if a better outcome in terms of physical frailty could be achieved with a regular home exercise program in women at high risk of fracture. ***Population group:*** Women who had been patients of an osteoporosis lab and had at least one fracture and with reduced bone mineral content (mean=74 years)	***Study Design:*** Quasi-experimental ***Data Collection:*** 2 years ***Power Rating*** = 1 ***Level*** IV B	Exercise program to improve posture and coordination. Supervised first 20 times, then women advised to train at least three times a week at home. At six-month intervals, participants could participate in five supervised training sessions. Intervention 7-12 years in duration (n=19). ***Control:*** No intervention (n=6).	• 47% (9) of exercisers and 33% (2) of controls reported at least one fall in the previous two years. 67% (4) of exercisers and 47% (9) controls reported a near fall. 1 person in exercise group and none in control group reported a fracture due to falling.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Lord et al. (1995) Australia	To determine whether a regular exercise program can improve balance, reaction time, neuro-muscular control, and muscle strength and reduce the rate of falling in older women. ***Population group:*** Seniors 65+ (mean=72 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 12 months ***Power Rating*** = 1 ***Level*** IV B	Exercise classes two times a week for one-year that targeted stretching, strengthening, aerobic, balance, flexibility, endurance, and hand-eye/foot-eye coordination (n=75). ***Control***: No intervention (n=94)	• There were no differences in the percentage of intervention participants (34.7%) and control participants (35.1%) who fell (RR=0.99, ns). • Exercisers demonstrated significant improvement in strength, reaction time, neuromuscular control, and body sway. Control participants displayed little or no improvement.
Reinsch et al. (1992) US	To reduce falls through exercise and cognitive behavioural interventions. ***Population group:*** Individuals from seniors centres (mean=75 years)	***Study Design:*** Quasi-experimental ***Data Collection:*** 12 months ***Power Rating*** = 2 ***Level*** III B	***Intervention 1***: Exercise intervention included a step up/step down exercise program three times per week for one year (n=57). ***Intervention 2:*** Cognitive behavioural intervention group met weekly for one year and covered a health and safety curriculum to prevent falls, relaxation training to lower tension and fear, and videogame playing to improve reaction time (n=51). ***Intervention 3:*** Exercise and cognitive behavioural intervention followed the I2 protocol once per week and twice per week focused on exercise for one year (n=72). ***Control***: Discussion group once per week covered health and discussion topics not specifically related to falls prevention for one year (n=50).	• The number of fallers did not differ significantly among the four groups (chi-square=2.21, ns). The likelihood of a severe fall-related injury also did not differ among the four groups. • There were no differences between the groups in strength, balance, or endurance at the end of one year.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Rubenstein et al. (2000) US	1. To measure the effects of an exercise intervention on strength, balance, and endurance among elderly men with risk factors for falls. 2. To measure the effects on fall rates, self-reported health measures, and activity levels. ***Population group:*** Senior men 70+ who had a risk factor due to lower extremity weakness, impaired gait/balance, or more than one fall in the previous six months (mean=75 years).	***Study Design:*** Random Control Trial ***Data Collection:*** 3 months ***Power Rating*** = 1 ***Level*** IV B	Three 90 minute exercise sessions per week for 12 weeks that included strength training, endurance training, and balance training (n=28). ***Control:*** No intervention (n=27).	▪ 38.7% of exercisers and 32.1% of controls reported falling, with a total of 13 and 14 falls respectively. ▪ Exercisers demonstrated significant improvement compared to controls in right knee flexion strength, right knee extension endurance, left knee flexion endurance, meters walked in six minutes, and POMI gait score.
Wolf et al. (1996) US	To evaluate the effects of Tai Chi and computerized balance training on specified primary outcomes and secondary outcomes (occurrence of falls). ***Population group:*** Seniors 70+ (mean=76 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 7-20 months ***Power Rating*** = 3 ***Level*** I B	***Intervention 1***: Tai Chi training two times per week for 15 weeks plus encouraged to practice at home (n=72). ***Intervention 2:*** Computerized balance training once per week for 15 weeks (n=64). ***Control***: Weekly discussion of topics of interest to seniors plus instructed not to change their level of exercise for 15 weeks (n=64).	▪ Using the FICSIT fall definition, relative to the control group, the Tai Chi group had a longer time to one or more falls (RR=0.63, p=.009) but no difference for the balance training group (RR=1.03, ns). There was no difference in time to one or more injurious falls (RR=0.95 and 1.36, ns for Tai Chi and Balance Training respectively compared to control). Adjusting for fall occurrence in past year, fear of falling, and trouble falling asleep produced results similar to the unadjusted outcomes. ▪ Risk factors that showed significant differences were that participants in the Tai Chi group compared to the control group had less loss of left hand grip strength, reduced ambulation speed, and lower systolic blood pressure after a 12-minute walk. No differences in balance training group compared to control.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Environment Modification Interventions				
Cumming et al. (1999) Australia	To determine whether occupational therapist home visits targeted at environmental hazards can reduce the rate of falls. ***Population group:*** Seniors 65+ who were inpatients of selected hospital wards, attended outpatient clinics, or from local day care centers for older people (mean=77 years).	***Study Design:*** Random Control Trial ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** I B	Occupational therapist home visits were conducted for a routine OT assessment plus a standardized home assessment form used to record home hazards. Participants received a list of recommended home modifications and the occupational therapist supervised any modifications. Telephone follow-ups were made to encourage participants to make modifications. Modifications were funded through "usual sources" available to older people who are OT clients (n=264). ***Control***: No intervention (n=266)	▪ Intervention participants were less likely to report at least one fall than control participants (35% vs. 45%, RR=0.81, p=.05). However, the effect seemed to be entirely due to the difference in falls among seniors who had reported a fall in the previous year. Among those who did not report a fall in the previous year, the proportion who fell was virtually identical in the intervention (32%) and control groups (33%) (RR=1.03, ns). For those who fell in the previous year, intervention participants (42%) were less likely to have at least one fall than control participants (65%) (RR=0.64, p=.001). ▪ At 12 month follow-up visit, between 49% (remove mats/rugs) and 75% (use non-slip bathmat) of recommendations had been made, with the exception of add rail to external stairs (19% compliance).

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Hornbrook et al. (1994) US	1. To determine whether non-fallers could reduce their likelihood of becoming fallers by adopting appropriate safety habits prior to suffering a fall; and, 2. Whether fallers would benefit from learning ways to reduce their chances of falling again. ***Population group:*** 65+ of a large HMO (mean=73 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 24 months ***Power Rating*** = 3 ***Level*** I B	Participants received a home inspection, and a safety booklet detailing common hazards and information on home repairs, including where to get assistance. Also invited to four weekly 90-minute classes and quarterly follow-ups to learn how to deal with environmental, behavioural, and physical risk factors. Participants encouraged to make home safety-related repairs and given financial and technical assistance to make the repairs (n=1455). ***Control***: Received a home visit at which time they received a home inspection, informed of hazards, and given safety booklet that identified common hazards (n=1571).	▪ After adjusting for length of follow-up, rate of self-reported falls per 1000 person-years was 16% lower in intervention group (586) than in control group (699). ▪ After adjusting for age & gender, falls in previous six weeks prior to intervention, days hospitalized last year, chronic medical conditions, intervention group less likely to fall (Adj OR=0.85, $p < .05$) but no difference in falls resulting in injury (OR=0.93, ns).
Plautz et al. (1996) US	To determine to what extent an intervention that focused primarily on the reduction of environmental hazards in the home was feasible and could decrease the rates of falls, scalds, and burns ***Population group:*** Seniors 75+ and seniors 60+ who had fallen in the previous year (mean=75 years)	***Study Design:*** Pre-post ***Data Collection:*** 6 months ***Power Rating*** = 3 ***Level*** II B	Participants counseled and given written material about injury risk factors due to home hazards. They also received a home assessment and home modifications were planned and completed for the participants. (n=141) ***Control:*** NA (pre-post)	▪ There was a significant decrease in falls from pre-intervention (59 falls, 0.810 falls per person-year) to post intervention (26 falls, 0.329 falls per person-year), $t=2.73$, $p=0.007$ as well as participants reporting one or more falls (35 (25%) pre vs. 13 (9%) post, chi-square=13.44, $p < .001$).

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Thompson (1996) Australia	To verify the results of a successful pilot program for reducing falls in the home through home modifications. ***Population group:*** Elderly (mean=74 years)	***Study Design:*** Pre-post ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** II B	Participants received a home safety inspection and modifications were made either free of charge or subsidize (n=305). ***Control:*** NA (pre-post).	▪ 69 (22.6%) participants fell in their home in the year prior to the intervention compared to 29 (9.5%) after the intervention, a reduction of 58% ($p<.05$). The number of falls dropped from 121 to 45, a reduction of 63% ($p<.05$). Falls requiring medical treatment fell from 38 to 17, an improvement of 55% ($p<.05$). ▪ The study targeted 215 residences, 205 of which had one or more grab-rails fitted and 36 had floors treated to improve grip.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Education Interventions				
Abreu et al. (1998) US	To explore the effectiveness of group versus home education in teaching fall prevention. ***Population group:*** Volunteers 60+ from the Little Council on Aging (mean=72 years)	***Study Design:*** Quasi-experimental ***Data Collection:*** 2 months ***Power Rating*** = 1 ***Level*** IV B	***Intervention 1:*** Group in-service on falls prevention through modification of risk factors (n=5). ***Intervention 2:*** Home visits that included identifying and information on modifying risk factors for falls (n=7).	▪ One fall occurred in the in-service group and no falls occurred in the home visit group.
Alkalay, Alcalay, & Sherry (1984) Israel	To determine whether specific preventive measures could significantly reduce falls ***Population group:*** Seniors	***Study Design:*** Pre-post ***Data Collection:*** 6 months ***Power Rating*** = 1 ***Level*** IV B	Group session about the causes and prevention of falls. Individual sessions with family physician and nurse concerning importance of reducing non-essential drug intake, especially tranquilizers and sleeping pills (n=74). ***Control:*** NA (pre-post)	▪ 18 (24.3%) participants fell in the six-month pre-intervention compared to 5 (6.8%) in the six-month post-intervention. ▪ A considerable reduction in the use of tranquillizers and hypnotics and repairs and alterations were made in several homes to prevention accidents.
Robson et al. (un-published) Canada	To reduce risk factors and fall rates for seniors participating in a brief community intervention. ***Population group:*** Healthy seniors (mean=73 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 4 months ***Power Rating*** = 2 ***Level*** II B	Two ninety-minute group sessions. Session 1 participants learned about falling risks and completed self-assessment for their own behavioural, physical, and environmental risk factors. Participants urged to reduce risk factors and tips were given to do so, including an exercise video. Session 2 was a social opportunity for participants to share their experiences (n=235). ***Control***: No intervention (n=236).	▪ No difference in falls between intervention and control groups (17% vs. 23%, ns). ▪ After adjusting for health status and living alone, a subgroup analysis of those who fell in the previous year revealed fewer treatment group (20%) than control group (33%) participants fell (Adj OR=2.16, $p<.05$). ▪ Among those who received the intervention, significant reductions were made in 7 out of 8 risk factors (paying attention, taking risks, footwear, foot care, vision, home hazards, balance, leg strength -- no change in medication).

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Ryan & Spellbring (1996) US	To pilot test the methodology of a fall prevention educational program and its influence on fall prevention among older women living in the community. ***Population group:*** Participants 65+ attending two senior meal sites (mean=78 years)	***Study Design:*** Quasi-experimental ***Data Collection:*** 3 months ***Power Rating*** = 1 ***Level*** IV B	***Intervention 1***: One-hour group educational session that emphasized threat of falling, increase belief that specific activities could increase safety, and recommend cost effective interventions (n= 16). ***Intervention 2:*** Same as Intervention #1, only delivered in one-to-one sessions (n= 14). ***Control***: One-hour health promotion session (n= 15).	• More control group (3) participants fell than group education (1) or one-to-one education (2). • Overall, 31 participants made at least one fall prevention change. 61% of changes were categorized as personal/no cost, 32% as environmental with cost (under $20), and 7% as environmental/no cost.
Schoenfelder & Van Why (1997) US	To develop a fall prevention program for community-dwelling older adults and to assess participants' responses to recommended fall prevention strategies. ***Population group:*** Older adults (mean=75 years)	***Study Design:*** Pre-post ***Data Collection:*** 3 months ***Power Rating*** = 1 ***Level*** IV B	Three session fall prevention education program that focused on raising awareness of the threat of falls, exercise as a fall prevention strategy, and home hazard identification and modification (n=14). ***Control:*** NA (pre-post)	• 46% (6 out of 13) participants reported falling in the previous year, at three month post-test, 2 out of 14 (14.3%) reported a fall. • Two participants reported making changes to their home.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Medication Interventions				
Armstrong et al. (1996) UK	To determine the effect of oral hormone replacement therapy plus calcium compared with calcium alone on balance, muscle performance, and falls. ***Population group:*** Post-menopausal women who had suffered a wrist fracture in the previous 7 weeks (mean=61 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 11 months ***Power Rating*** = 1 ***Level*** IV B	Participants took calcium daily and oral hormone replacement therapy (n=53). ***Control:*** Participants took calcium daily (n=55).	▪ No differences in falls between groups (37% of all participants fell at least once). ▪ Calcium only group had significantly improved leg extensor power.
Campbell et al. (1999) New Zealand	To assess the effectiveness of psychotropic medication withdrawal and a home-based exercise program in reducing falls in older people. ***Population group:*** Seniors 65+ taking benzodiazepine, any other hypnotic, or any antidepressant or major tranquilizer (mean=75 years).	***Study Design:*** Random Control Trial ***Data Collection:*** 10 months ***Power Rating*** = 3 ***Level*** I B	***Intervention 1***: Gradual medication withdrawal plus physiotherapist guided home exercise program that participants were to complete three times per week plus walk three times per week (n=24). ***Intervention 2:*** Gradual medication withdrawal only (n=24). ***Intervention 3:*** Exercise only (n=22). ***Control:*** No gradual medication withdrawal/no exercise (n=24).	▪ There was no difference in the unadjusted rate of falls for medication withdrawal versus no medication withdrawal (0.52 vs. 1.16 falls per person year, ns) or for exercise program versus no exercise program (0.71 vs. 0.97 falls per person year, ns). After adjusting for history of fall in previous year and total number of medications taken, the relative hazard for falls in the medication withdrawal group compared with the no medication withdrawal group was 0.34 ($p<.05$) and the relative hazard for the exercise program versus no exercise program was 0.87 ($p<.05$). Controlling for taking benzodiazepines and taking antidepressants did not change the magnitude or statistical significance of these relative hazard values. No interaction effect was found between the two interventions.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Clinical Assessment Interventions				
Baraff et al. (1999) US	To determine the effect of a practice guideline for the Emergency Department management of falls in community-dwelling seniors. ***Population group:*** Seniors 65+ of an HMO who presented to an Emergency Department for a fall (mean=76 years)	***Study Design:*** Cohort ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** II B	Practice guidelines were presented to the Emergency Department staffs as well as to internal medicine and family medicine care providers at the Emergency Department sites. Health information was also provided to the participants (n=597). ***Control:*** No intervention (n=907).	▪ There was no difference in the number of falls reported (36.2 fall/100 patient years at both pre- and post-intervention), nor any differences between pre- and post-intervention in the proportion of participants hospitalized for injuries, fractures, or falls. ▪ Compared to the pre-intervention, post-intervention participants were more likely to take daily calcium supplements and daily vitamin D.
Carpenter et al. (1990) UK	To test the benefits of regular surveillance of the elderly at home using an activity of daily living questionnaire administered by volunteers. ***Population group:*** Seniors 75+ who were members of a general practice	***Study Design:*** Random Control Trial ***Data Collection:*** 2 months ***Power Rating*** = 3 ***Level*** I B	Participants received periodic home visits by volunteers to complete an 18-item ADL scale. Based on their ADL scores, volunteers visited participants either every six months (no disability) or every three months (disability). Individuals found to have an increased disability score were referred to their general practitioners and those with specific requests were referred to the appropriate agency (n=181). ***Control:*** No intervention (n=186).	▪ In the study group, there was no increase in falls, with 12 recorded at both initial and final interviews. In the control group, 36 falls were reported in the month before the final interview compared with 17 in the month before the first interview.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Close et al. (1999) UK	To determine whether a structured bi-disciplinary assessment of elderly people who attend an accident and emergency department with a primary diagnosis of a fall could decrease the rate of further falls. ***Population group:*** Patients 65+ who attended the accident and emergency department with a primary diagnosis of a fall (mean=78 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** I B	Baseline medical assessment plus detailed medical assessment and occupational assessment in addition to usual care. Based on this information, primary cause for fall was assigned and identified risk factors modified if possible. A single home visit was undertaken by an occupational therapist to assess patient function and home hazards and to provide advice and education. Minor home modifications were made with the patient's consent and minor equipment was supplied directly by the occupational therapist. Referrals were made for larger repairs or equipment (n=141). ***Control***: Usual care (n=163)	▪ There were significantly fewer falls in the intervention group (183) than in the control group (510) (p=.0002). 32% (59) of intervention participants versus 52% (111) of control group participants reported at least one fall. There was no significant difference in the percentage reporting a fall resulting in serious injury 8 (4%) of intervention and 16 (8%) of control. After adjusting for function, cognition, and number of falls in previous year at baseline, the risk of falling was lower in the intervention group than control (Adj OR=0.39, p<.05) as well as the risk of recurrent falling (Adj OR=0.33, p<.05). ▪ Using the Barthel index as a measure of function, the intervention group had a significantly higher level of functioning than the control group at the end of the intervention, although both groups showed a decline from the beginning to the end of the study.
Fabacher et al. (1994) US	To evaluate the effectiveness of in-home geriatric assessment as a means of providing preventive health care and improving health and functional status of elderly veterans. ***Population group:*** Veterans 70+ (mean=73 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 12 months ***Power Rating*** = 2 ***Level*** II B	In-home assessment by nurse or physician assistant that included physical examination, health behaviour inventory, medication review, functional status, and home hazard inspection. Participants then received a letter detailing results of assessment and recommendations. Each participant also received 4-month follow-up visits for one year by volunteers or staff members to assist with compliance, provide additional information, and detect new problems (n=100). ***Control:*** No intervention (n=95)	▪ No significant difference in the number of intervention (14%) and control (23%) participants reporting a fall. ▪ Of participants for whom a recommendation was made, 63% got a hearing evaluation, 83% got an eye examination, 71% modified their home to reduce the risk of falls, 54% increased their physical activity.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Gallagher & Brunt (1996) Canada	To develop and evaluate a program designed to reduce falls among older people. ***Population group:*** Seniors 60+ (mean=75 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 6 months ***Power Rating*** = 1 ***Level*** IV A	Nurse conducted personal and home risk assessment and one counseling interview to provide feedback of results of risk assessment, ways to reduce risks, a motivational 13-minute video, and booklet entitled "Head Over Heals" (n=50). ***Control***: No intervention (n=50)	▪ There were no significant differences in falls between the study and control group after adjusting for baseline differences (F=2.39, ns). ▪ Participants in the intervention group acted upon approximately 50% of the recommendations for fall risk reduction.
Vetter, Lewis, & Ford (1992) Wales	To assess whether intervention by a health visitor could reduce the number of fractures. ***Population group:*** Patients 70+ from general practices	***Study Design:*** Random Control Trial ***Data Collection:*** 48 months ***Power Rating*** = 2 ***Level*** II B	Four-year intervention where health visitors visited participants at least once a year, those with health problems were visited more often. Risk factors targeted included poor nutrition, alcohol use, smoking, medication review, environmental hazards assessed and corrected, pressure put on local authorities to grit areas where these people lived when there was ice and snow, and exercise including fitness classes (n=450). ***Control:*** No intervention	▪ No differences between intervention and control groups in number who had sustained fractures (6.7% vs. 6.7%) or in the number experiencing a fall (40% vs. 31%, ns).

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Wagner et al. (1994) US	To reduce days of restricted activity in older adults by targeting risk factors for disability and falls. ***Population group:*** Seniors 65+ from a large HMO (mean=73 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 24 months ***Power Rating*** = 3 ***Level*** I B	Participants received a 60-90 minute visit with a specially trained nurse/educator to review their risk factors for falling and to develop a tailored follow-up plan to address identified risk factors and motivate seniors to increase physical and social activity. Follow-up options included interventions to address physical inactivity, excess drinking, home hazards, prescription drug use, and uncorrected hearing or visual impairments (referred or received information concerning resources in the community who could help) (n=635). ***Control 1:*** One-time visit from a nurse around chronic disease prevention (n=317). ***Control 2:*** Usual care (n=667)	▪ In the first year of follow-up, fewer participants in the experimental group (27.5%) reported falling than the usual care group (36.8%) due to a decrease in falls in the experimental group and an increase in the control group (difference = 9.3%, $p < .01$). Fewer participants in the experimental group (9.9%) than the control group (14.5%) reported a fall that resulted in injury ($p<.01$). There were no significant differences between groups during the second year of follow-up.
Weber et al. (1996) US	To reduce the incidence of injuries and accidents in the home and increase the senior's awareness of potential personal and environmental risks that could result in injury. ***Population group:*** Seniors (mean=81 years)	***Study Design:*** Pre-post ***Data Collection:*** 6 months ***Power Rating*** = 1 ***Level*** IV B	Individualized home assessment that resulted in each participant receiving an individualized written intervention care plan as well as a general home safety pamphlet (n=201). ***Control:*** NA (pre-post)	▪ 46 (22.3%) participants fell in the 6-month intervention period compared to 105 (52.2%) who fell in the previous year. ▪ 133 (66%) implemented one or more of the suggested interventions, the most frequent changes were establishing a system for daily telephone contact (50), changing to sponge bathing to eliminate use of bathtub (47), obtaining a personal emergency response system (34), purchasing bath mats (32), and installing grab bars in bathroom (30).

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Multi-Factorial Interventions				
Bezon et al. (1999) US	To describe a fall prevention project targeting low-income patients of a nurse-managed primary care clinic. ***Population group:*** Patients of a nurse run clinic located in the community of a housing project for the elderly and disabled (mean=70 years).	***Study Design:*** Pre-post ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** II B	Participants assessed for risk of falling using a risk assessment tool. Those scoring at high risk received an intervention to target identified risk factors. Interventions targeted control of chronic disease, medications, health lifestyle (diet and exercise), visual and hearing corrections, physical activity prescriptions, education, removing environmental hazards, exercise programs, footwear, and teaching the person how to fall and how to get up after a fall (n=115). ***Control:*** NA (pre-post)	• At the first appraisal, 30 individual (20%) had fallen, one year after implementation, only 4 (3%) of the 115 participants sustained falls. There was no indication how the post data was collected.
Kempton et al. (2000) Australia	To evaluate a multi-strategic, community-based intervention to prevent older people from falling ***Population group:*** Seniors 60+	***Study Design:*** Cohort ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** II B	Four year multi-strategic intervention targeting fall-related knowledge, attitudes, behaviours, and risk factors including footwear, vision, physical activity, balance and gait, medication use, chronic conditions, and home and public safety hazards. Strategies included awareness raising, community education, policy development, home hazard reduction, media campaigns, and working with clinicians and other health care professionals (n=1314). ***Control:*** No intervention (n=1131)	• No difference in falls or reduction in falls between groups pre to post. At follow-up there was a 20% lower age standardized rate of fall-related hospital admissions in the intervention relative to the control area (Rate ratio=0.80, $p<.05$). • After adjusting for age and sex, there was a significant effect of the intervention on perceptions of falls being preventable, risk of falling, and benefits of safe footwear.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Poulstrup & Jeune (2000) Denmark	To determine whether a community-based intervention using existing care staff and facilities could prevent fall-related injuries. ***Population group:*** Seniors 65+	***Study Design:*** Quasi-experimental ***Data Collection:*** 18 months ***Power Rating*** = 3 ***Level*** II A	Community-based program to address multiple risks, including fall risks, by education through mailed leaflets and talks; home visits to 70-79 year olds with the goal of informing, identifying, and reducing risk factors; and information on and identification of risk factors provided to home helpers of elderly (n=12,905; 5 municipalities). ***Control***: No intervention (n=11,460; 4 municipalities)	▪ During the project period, a total of 2006 fall injuries were registered of which 56% were fractures. Using logistic regression, adjusted for age, gender, and marital status, there was a non-significant reduction of all fractures in the intervention group compared to the control group (Adj OR=0.85, ns). Women had a significant reduction in lower extremity fractures (Adj OR=0.54, p=.02), and just below significance for hip fractures (Adj OR=0.55, p=.06). No significant reductions were found among men.
Steinberg et al. (2000) Australia	To assess the effectiveness of multi-component interventions in reducing the incidence of slips, trips, and falls. ***Population group:*** Individuals who attended branches of the National Seniors Association (community group of active Australians)	***Study Design:*** Quasi-experimental ***Data Collection:*** 17 months ***Power Rating*** = 2 ***Level*** III B	***Intervention 1***: Oral presentation, plus participants given video on home safety and pamphlet on fall risk factors and prevention (n=63). ***Intervention 2:*** Same as Intervention 1 plus one hour exercise class monthly plus exercise handouts and exercise video (n=69). ***Intervention 3:*** Same as I2 plus home safety assessment with financial and practical assistance to make home modifications (n=60). ***Intervention 4:*** Same as I3 plus a clinical assessment and advice on medical risk factors for falls (n=57).	▪ There were no differences in falls between groups either in total number of falls or the number of persons reporting a fall. However, the number of slips and trips were significantly higher in the education only group compared to the other three groups. Hazard ratios, adjusting for sex, age group, health status, living alone, history of previous slips/trips, and combining groups 2, 3, 4 which had very similar hazard ratios indicated that the interventions in the combined groups had a protective effect against the risk of slipping (0.42, p<.05), tripping (0.36, p<.05), and a marginally protective effect against falls (0.70, p=.058).

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Tinetti et al. (1994) US	To assess the effectiveness of a multi-factorial targeted risk-abatement strategy in reducing the risk of falls and targeted risk factors. ***Population group:*** HMO enrollees 70+ (mean=78 years)	***Study Design:*** Random Control Trial ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** I A	Participants received an individualized intervention based on a baseline assessment. Interventions were for three months and included behavioural recommendations to reduce hypotension, education about sedative-hypnotic agents, review of medications with primary physician, training in transfer skills in bathroom and alterations to bathroom equipment, removal of home hazards/installation of safety devices, gait training/use of assistive devices, balance and strengthening exercises. Staff then contacted participants monthly for three additional months (n=147). ***Control***: Received home visits from social work students during which structured interviews were conducted. The number of social visits was matched to the estimated number of visits by a nurse practitioner or physical therapist for intervention group participants with comparable risk factors (n=144).	• Longer time to first fall for intervention participants compared to control participants ($p = 0.05$) and in the proportion that fell (35% vs. 47%, OR=0.75, $p = 0.04$). Intervention participants had 94 falls versus 164 for controls resulting in fewer falls per person week (OR = 0.64, $p < .05$). Little change in odds ratios after adjusting for age, sex, previous falls, and number of risk factors as well as the week of follow up for the incidence rate ratio. • Compared to baseline, 4.5 months later a significantly smaller percentage of the intervention group compared to the control group continued to use at least four prescription medications, to transfer unsafely to bathtub or toilet, or to have impairment in balance or gait. Overall, the intervention group had a mean decline of 1.1 in the total number of risk factors, as compared to a decrease of 0.6 in the control group ($p=0.03$).
Wolf-Klein et al. (1988) US	To evaluate the effectiveness of a clinic for reducing falls. ***Population group:*** Patients attending a falls clinic (mean=77 years)	***Study Design:*** Pre-post/descriptive ***Data Collection:*** 12 months ***Power Rating*** = 3 ***Level*** II B	A health care team assessed patients for the possible causes of falling and interventions put in place as a result of the assessment including medical management, home environment adaptation, and education around appropriate equipment and precautions. Follow-up was included whenever necessary. (n=36) ***Control:*** NA (pre-post)	• Prior to attending the falls clinic, 18 (50%) patients fell monthly or more frequently, 14 fell semi-annually, and four had fallen only once in the past year. At one-year follow-up, 28 (77.7%) had experienced no additional falls and 6 (17%) continued to fall, but less frequently. Only two patients continued to fall as often as they had.

Author, Country	Study Purpose, Population group	Study Design, Data Collection, Power Rating, Level	Interventions, Control	Study Results
Ytterstad (1996) Norway	To describe a community-based program to prevent fractures resulting from falls. ***Population group:*** All seniors 65+ living in or around Harstad	***Study Design*** Cohort ***Data Collection:*** 60 months ***Power Rating*** = 3 ***Level*** II A	As part of a larger, 5-year comprehensive, community-based program designed to prevent accidental injuries, an injury prevention group was formed consisting of hospital, public, and private organizations. The focus of the fall prevention component of the intervention was on detecting and preventing environmental hazards, both in and out of the home. Strategies included a health fair; media campaigns; home visits to promote environmental safety; healthy diet and lifestyle; reduction of isolation and inactivity; special health station for health consultations for seniors; fitness classes for seniors; greatly subsidized home modification service; anti-slip and safe footwear equipment was made available; and delivery of sand to homes for gritting driveways, stairs, and yards was arranged (n=8,120 person years [pre] & 14,850 person years [post]). ***Control:*** NA (pre-post)	• There were 152 fractures due to falls in private homes in period 1 (3 years) and 205 in period 2 (5 years), resulting in a significant reduction of 26.3%, (RR=0.74, p=0.006). Fractures occurring in traffic areas in winter were halved for men (RR=0.49 for 65-79 year old males, p=0.032 and 0.52 for 80+, ns but very small n). There were do differences in fractures in traffic areas for women.

APPENDIX 2:
Resources for Practitioners

RESOURCES FOR PRACTITIONERS

National Resources:

AIM – Adult Injury Management	
Comprehensive guide for communities interested in implementing strategies for the prevention of unintentional injuries among older adults and adults with disabilities. *$15.00*	Elaine Gallagher AIMNet, Centre on Aging, University of Victoria Victoria, BC V8X 2Y2 Tel: (250) 721 6463 Fax: (250) 721 6499 E-mail: AIMNet@uvic.ca Website: www.aimnet.bc.ca
Best Practice Programs for Injury Prevention	
Reports on a variety of projects under the supervision of "Frailty & Injuries: Cooperative Studies of Intervention Techniques" (FICSIT).	Ontario Injury Prevention Resource Centre Tel: (416) 367-3313 1-800-267-6817 Email: injury@web.net
Bruno and Alice: A Love Story in Twelve Parts About Seniors and Safety	
Twelve illustrated stories of two active seniors who, through lack of prevention, end up in awkward situations and almost miss their rendezvous with love. The stories offer insight into some of the personal prevention measures seniors can take to make their environment safer and prevent injuries. *Available on the website.*	Health Canada Division of Aging and Seniors 473 Albert Street, Postal Locator: 4203A Ottawa ON K1A 0K9 Tel: (613) 952-7606 Fax: (613) 957-7627 Email: seniors@inet.hwc.ca Website: www.hwc.ca/datahpsb/seniors/index.htm
Cherish Your Independence: Fall Prevention Manual	
This manual provides information on the magnitude of the problem of falls and fall injuries, risk factors for falls and areas for intervention.	Ottawa-Carleton Health Department Safety Program[me] Tel: (613) 722-2242
Community Action and Injury Prevention: A Guide	
A guide to support individuals and their community groups who are taking action to prevent injury. Intended to assist communities plan and implement an injury prevention strategy. It is organized into a series of 6 publications. *The Introduction, and Injury Prevention Primer are available on the website.*	Ontario Public Health Association Kathleen Orth Tel: (416) 367 3313 ext. 22 Email: keorth@opha.an.ca Website: www.opha.on.ca/publications/intro&primer.pdf
Directory of Physical Activity and Exercise Programs (PEP), for Older Adults	
The PEP directory is designed to help locate activity programs designed for older adults in the City of Edmonton. Each type of activity has been rated for its main benefits.	Jennifer Tuininga Project A.B.L.E. Alberta Centre for Well-Being 3rd Floor, 111759 Groat Road, Edmonton, AB T5M 3K6 Tel: 453-8692 or 674-6062 Fax: 455-2092 E-mail: Jennifer.tuininga@ualberta.ca
Directory of Substance Abuse & Injury Prevention Contacts in Public health	
Directory of program contacts.	Ontario Injury Prevention Resource Centre Tel: (416) 367 3313 1-800-267-6817 Email: injury@web.net

Directory of Tools and Resources for Seniors Living in the Community - French	
(Répertoire des outils et ressources disponibles en prévention des chutes pour les personnes âgées vivant a domicile).	Charles Lemieux 205-1 boulevard de York ouest Gaspé, QC G4X 2W5 Tel: (418) 368-2443 Fax: (418) 368-1317
Enhancing Safety and Security for Canadian Seniors - Setting the Stage for Action	
This report focuses on safety and security issues for older Canadians (injuries, elder abuse and crime). It can be used as a planning document and evaluation framework for governments, organizations and local authorities to assess their capacity to promote safety and security for seniors.	Health Canada Division of Aging and Seniors Website: www.hc-sc.gc/seniors/english/whatsnew.htm
Falls Prevention Guide for Seniors - Shedding Light on Falls	
This guide is divided into sections outlining a different risk for falling and what you can do about it.	North York Coalition for Seniors' Falls Prevention Tel: (416) 756 5050 Email: falls@nygh.on.ca Website: www.sunnybrook.utoronto.ca/~csia/Falls&Mobility/fallsmain.htm
Guide for Seniors for Installation and Security in the Bathroom - French	
(Guide de sensibilisation relatif à l'aménagement, au comportement et à l'entretien sécuritaires de la salle de bain par les personnes âgées vivant a domicile)	Charles Lemieux 205-2 boulevard de York ouest Gaspé, QC G4X 2W5 Tel: (418) 368-2443 Fax: (418) 368-1317
Home Safe Home: Road Show	
This kit is designed as a practical resource for people working to prevent injuries and promote independent living and includes the following: ▪ A Facilitator's Manual including 2 workshops, a workshop booklet and adaptive devices brochure ▪ Sample copies of resources suitable for workshops participants and general community distribution The workshop booklet, brochure, videos and some resources are available in Chinese (Cantonese). *$30.00*	Elsie Petch South Riverdale Community Health Centre 955 Queen Street East Toronto, ON M4M 3P3 Tel: (416) 461-1925 ext. 243 Fax: (416) 469-3442
Home Support Exercise Program (HSEP)	
Ten simple, exercises designed to enhance and maintain functional fitness, mobility, and independence of home-bound older adults. Picture package *$50.00* Training Package *$200.00* Additional resource manual *$25.00* Workshop (includes resource manual *$75.00* Training for the Trainer (includes training package)*$250.00*	The Centre for Activity and Ageing The University of Western Ontario London, ON N6A 3K7 Tel: (519) 661-1603 Fax: (519) 661-1612
Proper use of drugs – French	
(Utilisation judicieuse de médicaments) This booklet describes community programs/approaches for the promotion of healthy drug use by seniors living in the community.	Elsie Petch South Riverdale Community Health Centre 955 Queen Street East Toronto, ON M4M 3P3 Tel: (416) 461-1925 ext. 243 Fax: (416) 469-3442

Profile of Community Projects, 1995-96	
Reports on a number of Ontario-based community programs in injury reduction.	Ontario Injury Prevention Resource Centre Tel: (416) 367 3313 1-800-267-6817 Email: injury@web.net
Steady As You Go (SAYGO) Client Handbook	
A 52-page guide for people to assess their personal risks for having a fall and to learn what to do to avoid them. It includes three inserts (1) fridge magnet, (2) calendar, (3) scorecard. *$8.00*	Elli Robson, Health Strategy Researcher, Capital Health Regional Public Health, Suite 300, 10216 – 124 Street, Edmonton, AB T5N 4A3 Tel: (708) 413-7955 Fax: (780) 482-4194
Steady As You Go (SAYGO) Agency and Facilitators Manual	
An 80-page manual, which outlines what agencies, facilitators and supporting health professionals need to know to run SAYGO in their communities. Only one copy needed per community, as reproduction rights are included in the cost. *$65.00*	Elli Robson, Health Strategy Researcher, Capital Health Regional Public Health, Suite 300, 10216 – 124 Street, Edmonton, AB T5N 4A3 Tel: (708) 413-7955 Fax: (780) 482-4194
Taking Steps/Modifying Pedestrian Environments to Reduce the Risk of Missteps and Falls	
Comprehensive manual on making our streets, buildings and walkways safe for seniors and people with disabilities who are at risk of serious injury from falls. *$15.00*	Elaine Gallagher AIMNet, Centre on Aging, University of Victoria Victoria, BC V8X 2Y2 Tel: (250) 721 6463 Fax: (250) 721 6499 E-mail: AIMNet@uvic.ca Website: www.aimnet.bc.ca
The Steps Project/A Project to Reduce Falls in Public Places Among Seniors and Persons with Disabilities	
A detailed analysis and set of recommendations from a community-based survey of 791 people who experienced a misstep or fall during a 9-month period. *$15.00*	Elaine Gallagher AIMNet, Centre on Aging, University of Victoria Victoria, BC V8X 2Y2 Tel: (250) 721 6463 Fax: (250) 721 6499 E-mail: AIMNet@uvic.ca Website: www.aimnet.bc.ca
The Safe Living Guide	
This guide is useful to seniors and those who care for them. It contains ideas on how to prevent injuries around the house. It also contains several stories that show how people who made changes in their homes or in their lives benefited from them. Practical information in the form of fact sheets and tips, as well as a resource section, completes the guide. The guide can be used by itself or in the context of discussions or workshops with seniors.	Health Canada Division of Aging and Seniors Website: www.hc-sc.gc/seniors/english/whatsnew.htm
You Can Do It! A Community Guide for Injury Prevention	
This guide describes the steps for developing an injury prevention program. A discussion of steps are intended to provide the reader with a comprehensive understanding of injury program development, implementation and evaluation. *$10.00*	Injury Awareness and Prevention Centre University of Alberta 4075-RTF, 8308-114 Street Edmonton, AB T6G 2E1 Tel: (780) 492 6019 Fax: (780) 492-7154 Email: acicr@ualberta.ca

You Can Make a Difference	
A handbook for community action for injury prevention designed to assist those individuals/organizations who would like to take action to prevent injuries. It provides a general overview of the problem of injuries; describes a process for developing and implementing strategies to reduce injuries; and includes information on how to promote and evaluate community injury prevention projects. *Limited supply*	Office for Injury Prevention, BC Ministry of Health 1515 Blanchard Street, Victoria, BC Tel: (250) 952 1742 1-800-465-4911

International Resources:

AARP: Fixing to Stay	
A national survey of housing and home modification issues. May 2000.	AARP 601 E Street, NW Washington, DC 20049 Website: www.aarp.org
A Tool Kit to Prevent Senior Falls	
Materials designed for fall prevention programs, not for individual use.	US Centres for Disease Control and Prevention Website: www.cdc.gov/ncipc/pub-res/toolkit/toolkit.htm
Check for Safety	
A home fall prevention checklist for older adults.	US Centre for Disease Control and Prevention Department of Health and Human Services Website: www.cdc.gov/nicp/pub-res/toolkit/checkforsafety.htm
Demonstrating Your Program's Worth. A Primer on Evaluation for Programs to Prevent Unintentional Injury	
This book is designed to help program staff understand the processes involved in planning, designing and implementing evaluation of programs to prevent unintentional injuries.	US Centre for Disease Control Website: www.cdc.gov/ncipc/pubres/demonstr.htm
Major Causes of Unintentional Injuries among Older Persons	
An annotated bibliography.	US Centre for Disease Control Website: www.cdc.gov/ncipc
Remembering When: A Fire and Fall Prevention Program for Older Adults	
This guidebook contains everything you will need to conduct a comprehensive fire and fall prevention program for older adults in your community.	National Fire Protection Association Centre for High-Risk Outreach 1 Batterymarch Park Quincy, MA 02269 Website: www.nfpa.org
Universal Design and Home Modification Comfortable, Safe, Convenient Living	
This booklet describes how universal design features make a home conducive to independent living. AARP recently co-sponsored the building of a house to serve as a showcase for universal design features, the highlights of which are described in this booklet. The products and design features in the house are attractive and accommodate continually changing needs as residents grow older.	AARP Consumer Issues Section 601 E Street, NW Washington, DC 20049 Website: www.aarp.org

VIDEOS:

Head Over Heels	
A step-by-step video designed to give seniors facts about falls. The video helps overcome the fear of falling which many seniors experience. *$39.00*	Elaine Gallagher AIMNet, Centre on Aging, University of Victoria, Victoria, BC V8X 2Y2 Tel: (250) 721 6463 Fax: (250) 721 6499 E-mail: AIMNet@uvic.ca Website: www.aimnet.bc.ca
Home Grown Solutions Demonstration Project	
Housing initiatives for persons with disabilities – 23 minutes. *$13.50*	Jeannette Hughes 206-9843 Second Street, Sidney, BC V8L 3C7
Home Support Exercise Program (HSEP)	
Exercise program video.	The Centre for Activity and Ageing The University of Western Ontario London, ON N6A 3K7 Tel: (519) 661-1603 Fax: (519) 661-1612
Kitchen Comforts (Kitchen Safety) & You May Live to Be 90 and 9.	
Part of the Home Safe Home: Road Show Program. *(See above under National Resources)*	Elsie Petch South Riverdale Community Health Centre 955 Queen Street East Toronto, ON M4M 3P3 Tel: (416) 461-1925 ext. 243 Fax: (416) 469-3442
Stairway and Falls	
This two-hour video is based on the workshop entitled "Stairway and Falls," presented by Jake Pauls. *$40.00*	Jake Pauls Tel: (301) 933-5275 E-mail: bldguse@aol.com
Steady As You Go (SAYGO) Fitness for Preventing Falls	
A 30-minute video including short vignettes of seniors who have had falls and the impact it has had on them. There is also a 20-minute exercise program for leg strength and balance. The handbook and video are also available in Chinese (Cantonese). *$8.00*	Elli Robson, Health Strategy Researcher, Capital Health Regional Public Health, Suite 300, 10216 – 124 Street, Edmonton, AB T5N 4A3 Tel: (708) 413-7955; Fax: (780) 482-4194
Stepping Out	
This lively 25-minute video takes a positive and proactive look at the environmental challenges faced by seniors and people with disabilities. *$39.00*	Elaine Gallagher AIMNet, Centre on Aging, University of Victoria, Victoria, BC V8X 2Y2 Tel: (250) 721 6463; Fax: (250) 721 6499 E-mail: AIMNet@uvic.ca Website: www.aimnet.bc.ca

U.S. Architectural and Transportation Barriers Compliance Board	
A series of four short videos (8 to 12 minutes each) on pedestrian safety for persons with visual and mobility impairments. *Cost is for shipping only.*	The Access Board 1331 F Street, NW, Suite 1000 Washington, DC 20004-1111 (202) 272-5434 (v) - (202) 272-5449 (tty) – (202) 272-5447 (fax) (800) 872-2253 (v) - (800) 993-2822 (tty) email: info@access-board.gov

WEBSITES:

1. **http://www.canadian-health-network.ca/1injury_prevention.html**

- Canadian website
- The Canadian Health Network (CHN) is a national, bilingual Internet-based health information service. Health Canada, its founding partner, provides funding for CHN.

Through this website, the Canadian public and health intermediaries alike can find excellent resources from health information providers across Canada. The CHN seeks to establish itself as Canadians' premier source of "health information you can trust." CHN features 26 health centres focused on major health topics and population groups.

To date, there are links to more than 6,000 Internet-based resources on the CHN site. The CHN Subject Index includes over 1,000 terms pointing to information in these resources.

2. **http://www.sppd.gc.ca/default_e.html**

- Canadian website
- The Canadian Seniors Policy and Program Database (SPPD) is a database of government policies and programs for which seniors are the primary beneficiaries. It was developed and is maintained by federal, provincial and territorial governments.

3. **http://www.hc-sc.gc.ca/seniors-aines/**

- Canadian website
- Health Canada – Injury Prevention and Seniors

The Division of Aging and Seniors, Health Canada, provides federal leadership in areas pertaining to aging and seniors. The Division serves as a focal point for information and centre of expertise.

This website provides:

- A list of Injury Prevention programs/projects throughout Canada sub-listed by each province as well as a brief description and contact person name of each project.
- An extensive list of Injury Prevention publications. A link to most publications is provided.
- A library of web-links to other injury prevention websites in Canada.

4. **http://www.safecommunities.ca/**

- Canadian website
- The Safe Communities Foundation works in partnership with the private and public sectors to improve the health and safety of workers and people throughout your community. The goal of the Foundation and all participating Safe Communities in Canada is to eliminate injuries while promoting a culture of safety through the implementation of programs and education.

5. **http://www.med.ualberta.ca/acicr/**

- Canadian website
- The Alberta Centre for Injury Control and Research (ACICR) strengthens and helps coordinate injury control in Alberta. This Centre provides support for agencies, practitioners and other key stakeholders who do work related to injury prevention, emergency medical services, acute care and rehabilitation. ACICR is a part of an expanding network of injury control expertise that reaches not only across Alberta but throughout Canada and around the world.

6. **http://www.injuryresearch.bc.ca/**

- Canadian website
- The British Columbia Injury Research and Prevention Unit's mission is to make British Columbia a safe place by coordinating efforts, research and prevention that will significantly reduce injuries and their consequences.

7. **http://www.sunnybrook.utoronto.ca/~csia/Falls&Mobility/fallsmain.htm**

- Canadian website
- The Sunnybrook & Women's Clinical and Research "Program in Aging" has established a provincial network of institutions and individuals interested in measures to increase the mobility of older people while reducing the number of injuries caused by falls. The Centre for Studies in Aging is responsible for providing the academic support to the Program and to this Network. The activities being undertaken by the Network currently include: establishing consensus on Fall Risk Assessment across a variety of settings and levels of risk; planning and coordinating intervention studies; developing networking and communication strategies.

  One of the goals of this website is to provide service to the Ontario Falls and Mobility Network by acting as a central repository of knowledge and information in the field.

8. **http://www.uwo.ca/actage/**

- Canadian website
- The mission of Canadian Centre for Activity and Aging (CCAA) is to develop, encourage and promote an active, healthy lifestyle for Canadian adults that will enhance the dignity of the aging process.

9. **http://www.cdc.gov/ncipc/ncipchm.htm**

- United States website
- National Centre for Injury Prevention and Control (NCIPC) is a national program to reduce injury, disability, death, and costs associated with injuries outside the workplace. As the lead federal agency for injury prevention, NCIPC works closely with other federal agencies; national, state, and local organizations; state and local health departments; and research institutions.

10. **http://joannabriggs.edu.au/FALLS/**

- Australian website
- Australian National Falls Network as part of The Joanna Briggs Institute For Evidence Based Nursing & Midwifery. This institute is an International Research Collaboration based at the Royal Adelaide Hospital and the Adelaide University with collaborating centres in Australia, New Zealand and Hong Kong. This website provides good links to falls and fall-related research.

11. **http://infowest.maribyrnong.vic.gov.au/fallsprevention/html/abou.htm**

- Australian website
- Maribyrnong Council is committed to the prevention of falls by promoting community knowledge to reduce the number of fall injuries to older adults in the City of Maribyrnong, including; private homes, public spaces, shopping areas and aged accommodation.

  This website provides information for seniors in the community. It has information booklets in Vietnamese, Spanish, Italian and English.

APPENDIX 3:
Evaluation Guide for Falls Prevention Programs

Falls Prevention Program Evaluation

I. What is Evaluation?

Evaluation is the process of determining whether programs or specific aspects of programs are effective, efficient, appropriate or meaningful, and if not, how to make them so. Additionally, evaluation will produce the information to show if a program has unexpected benefits or problems. Evaluation should be considered a critical and integral component of any program[1] that is included from the planning stages onward. It can include a wide variety of methods to evaluate many aspects of the program. There are numerous books, manuals, web pages and other materials that provide in-depth information on conducting evaluations. However, one does not have to be an expert to carry out a useful evaluation. Programs that demonstrate through evaluation a high probability of success have a much greater chance of receiving community, regional, financial and legislative support.

II. Purpose of Evaluation

Many people believe that evaluation is about proving the success or failure of a program. This is not necessarily the case. Evaluation enables you to provide the best possible programming in your community. It helps you learn from mistakes, modify steps of your program as you progress and ultimately determine if you have reached your final goal. Without evaluation you cannot tell if the program is actually helping the people you are targeting.

Evaluation provides opportunities for those involved, both participants and programmers, to have important input in the programming process. Participants' experiences are valuable sources of information. By asking them what worked and what did not, and what they would recommend for future programming, future pitfalls can be avoided and valuable insights gained. It also provides participants with an important message—their opinions and experiences count! Similarly, involving programming staff in the evaluation process provides an opportunity to let them know that their work is making a difference!

III. Why Evaluate Fall and Injury Prevention Programs?

Evaluation to many is seen as something that takes away scarce dollars and resources from service delivery with no real benefits to the program. However, properly conducted evaluations can serve many useful functions that ultimately can greatly improve a program. Some of the potential benefits of evaluation are:

- accounting for what has been accomplished through project funding;

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[1] Because of the terminology typically used around evaluation, in this section we refer to "program" evaluation. However, many of the same issues and principles would apply to "policy" evaluation.

- promoting learning about which health promotion strategies work in communities and which do not;
- contributing to the body of knowledge about injury prevention;
- learning whether proposed program materials are suitable for your intended audience;
- learning whether program plans are feasible before they are put into effect;
- learning whether programs are producing the desired results;
- learning whether programs have unexpected benefits or problem;.
- enabling planners and providers to improve and build on existing program services;
- producing data, which will inform future programs/policy;
- learning whether specific aspects of the program need to be changed while others should remain;
- demonstrating effectiveness to the community, to current or potential funders, or to those who want to conduct similar programs; and,
- contributing to policy development.

A well-designed evaluation produces information that may not have been expected. The information will include aspects that are not working as effectively as planned, as well as aspects that are surpassing expectations. Understanding why some things work well, and others do not, provides an opportunity to improve and tailor programs.

IV. Components of an Evaluation

A. Basic Steps:

Every program evaluation should include the following:

1. A clear and specific statement defining the objectives of the evaluation. This includes *measurable* project goals that outline what the project plans to accomplish. Although this may seem self-evident, many evaluations have gone off-track because this initial work has not been done. The more focused you are about what you want to examine, the more efficient you can be in your evaluation, the shorter the time it will take you and ultimately the less it will cost.
2. A defined target population and a comparison group (this could be one group with a pre- and post-test used to determine a difference). Be as specific as possible.
3. A written outline of the type of information to be collected and how that information relates to your program's objectives. This might include: what information the project needs to collect, who has the information and how the information will be collected.
4. A method for the collection of information that is suitable for the objectives of the evaluation and that will produce the type of information you are looking for.
5. A plan for designing and testing the instruments you will use to collect the information (i.e., are the instruments written in appropriate language for your participants, feasible to administer in the time available, and do they capture the required information?).
6. Collection of information from the members of the target population.
7. Recording of the information in a form that makes it possible to analyze.
8. Analysis of the recorded information.
9. Written evaluation report describing the evaluation's results.

B. Planning Your Program Evaluation

Ideally, evaluation is an integral part of the programming cycle that begins as soon as the idea for a fall or injury prevention program is conceived, interweaves with program activities throughout the life of the program and either ends after the program is finished or continues on to determine if the program has effects over a sustained period of time.

A brief overview, which might help you prepare the evaluation, introduces the evaluation process to colleagues, and guides your evaluation report, includes examining five key evaluation questions:

1. Did we do what we said we would do?
2. What did we learn about what worked and what did not?
3. What difference did it make that we did this work?
4. What could we do differently?
5. How do we plan to use evaluation findings for continuous learning?

The cost will depend on the type of evaluation required, however a good rule-of-thumb is to budget 10% of your total program costs for evaluation. Further, you may want to consider bringing in or hiring a program evaluation consultant to help develop, implement, and summarize your evaluation.

C. Types of Evaluation

There are many different evaluation approaches: needs assessments, accreditation, cost/benefit analysis, effectiveness, efficiency, formative, summative, goal based, process, outcome, etc. However, there are a few basic types of information that are most common:

1. **Formative Evaluation** – This helps to answer: "Is the program we are proposing likely to be effective among our intended target audience?"
   When to use: during the development of a new program or when an existing program is being modified; has existing problems with no obvious solutions or is being used with a new population.
   What it shows: whether proposed strategies are likely to reach, be understood by, and accepted by your target audience.
   Why is it useful: maximizes likelihood that the program will be successful and allows programmer to make revisions before full effort is underway.

2. **Process-Based Evaluation** - This helps to answer: "How well is the program really working and what are its strengths and weaknesses?"
   When to use: as soon as program begins.
   What it shows: how well a program is working or going according to initial plan.
   Why is it useful: identifies early problems and helps evaluate how well strategies, and materials are working.

3. **Impact Evaluation** – This helps to answer: "To what degree did the program meet its (intermediate) goals?"
   When to use: after the program has run through a cycle with contact from members of target audience.
   What it shows: the degree to which program met its intermediate goals (i.e., how many people changed their behaviour or environment?).
   Why is it useful: provides useful planning data to programmers for future planning and funding purposes.

4. **Outcome-Based Evaluation** - This helps to answer: "What benefits should participants of my program expect?"
   When to use: when program is complete.
   What it shows: the degree to which the program has an effect on the health outcomes of participants.
   Why is it useful: provides evidence of success for future planning, funding, and health promotion.

D. Action Plan Checklist for Program Planning and Evaluation

The following is a checklist to be used for program planning and evaluation:

1. First investigate to determine if an effective program similar to your idea already exists either in your community or somewhere else. A good source of information may be the companion document to this report, entitled: *A National Inventory of Canadian Falls Prevention Programs* (2001).
2. If a similar program does exist, talk with the program coordinator and read the evaluation report. Tailor the program as necessary to meet your needs.
3. Decide where you will seek financial support;
   - find out which community, regional, provincial or federal agencies provide grants for the type of program you are planning; and,
   - service clubs (i.e., Rotary, Lions etc.) or business (banks or credit unions) will often support your program.
4. Decide where you will seek non-financial support:
   - find out which regional or provincial agencies provide technical assistance for the type of program you are planning (i.e., Regional Health Authority, BC Injury Research and Prevention Unit, Adult Injury Management Office at the University of Victoria Centre on Aging, Office for Injury Prevention, BC Ministry of Health); and,
   - find out which community and business groups will support your program and provide some sort of support (i.e., local Fire Department, Public Health Unit).
5. Develop an outline of a plan for your fall and/or injury prevention program. Remember to plan your evaluation at this stage. Evaluate the outline. Talk to a small number of people you will try to reach with your fall and/or injury prevention program. Consult people who have experience with programs similar to the one you envision. Ask them to review your plan and modify based on their feedback.

6. Develop a plan to enlist financial, technical and other support you need from the agencies, businesses or community groups you have identified. Use your outline of the program plan to demonstrate your planning, commitment and expertise.
7. Put your plan for enlisting support into action. Keep track of contacts that you make, their feedback and commitments of support.
8. If unexpected problems arise while seeking support, re-evaluate. Determine why support is not forthcoming and ask for recommendations or modifications to ensure funding or recommendations of other more appropriate organizations to target.
9. Develop and test your instruments, procedures and materials. Ask a small number of people from your target group as well as any organizations that have committed to providing technical support to review your materials and modify based on feedback.
10. Begin program implementation.
11. Keep track of program-related contacts, participants, supporters and critics. Track all items either distributed to or collected from participants throughout the life of the program.
12. If unexpected problems arise while the program is in operation, re-evaluate to find the cause and solution.
13. Use the data you have collected to evaluate how well the program met its goals.
14. Use the results of this evaluation to justify continued funding and support for your program.
15. Share the results of your program and evaluation with others through newsletters, teleconferences, provincial conferences and other publications.

E. Other Things to Consider

In addition to the areas covered above, there are other things that can be considered when developing a new program with the goal of reducing falls or fall-related injuries. However, three important considerations include program acceptability, feasibility, and sustainability.

1. Acceptability

Reducing falls and fall-related injuries typically requires changing people's behaviour or environment. Changing behaviour or modifying one's living area is often difficult for anyone, and seniors are likely to be as resistant to change as anyone else. One of the barriers in working with seniors is that they must first accept that something needs to change, and many seniors tend to relate changes associated with reducing falls as a sign of their getting old and frail. Such a stigma creates resistance to change. Change often requires engaging in new behaviours, such as exercise, for which there are adherence issues, or allowing "intrusive measures" such as home modifications. These barriers to adopting risk factor reduction strategies are further complicated by seniors seeing these changes as evidence of the aging process. These barriers point to the great need to consider how to make the program strategies for change as acceptable as possible to seniors. The type of intervention, the degree of involvement of the target audience in forming and implementing the program, and the manner in which information and the program is presented to seniors can all impact the target population's ultimate acceptance of the program.

2. Feasibility

When planning a new program, one of the considerations should be whether the program could be successfully implemented. Issues around feasibility have been discussed throughout this document, particularly concerning the cost around reducing risk factors and having the necessary human resources, knowledge, and skills to implement the program. Other factors that may be taken into consideration around feasibility include ensuring the correct infrastructure is in place for delivering and managing the program and ensuring that all the elements are in place to be able to address the selected risk factors. Feasibility is also an important component of implementing new policy, as considerations must be made to ensure that organizations and individuals have the capacity and resources to be able to implement and follow the policy. Otherwise, the policy will likely be ineffective, no matter how well intentioned it may be.

3. Sustainability

Sustainability refers to the ability of a program to continue after the initial start up. Many of the issues concerning feasibility also apply to sustainability, but there are also other considerations. After the initial enthusiasm of developing and implementing a new program has worn off, it is necessary to ensure that the proper management and infrastructure exist to continue the program. Further, funding to start a program is often of limited duration, and there is a need to secure reliable, sustainable funding into the future. Program evaluation is particularly important in obtaining additional funding, as programs that can demonstrate that they are rated highly by the target audience and have a positive impact will likely receive greater interest, consideration, and support than programs that cannot provide such evidence.

IV. Evaluation References

Minister of Health & Welfare Canada. (1996). Guide to project evaluation: a participatory approach. Ottawa, Ontario.

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